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The

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American Physical Education Association

VOL. VII MARCH, 1936 No. 1

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Studies in the Physiology of Activity: I. On Certain Reactions of College Women to Measured Activity*

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INTRODUCTION

THE SELECTION of activities adapted to the needs and capacities of the individual is essential to an ideal physical education program. Evaluation of the potential contribution of an activity to any one of the several aspects of development or adjustment can be sound only if it is based upon the reactions of individuals to the activity.

Common experience and observation have brought recognition of the importance of big-muscle activities in "organic development" and in the attainment and maintenance of "physiological health," and principles of the physiology of exercise developed by Benedict, Dill, Henderson, Hill, McCurdy, Schneider, and others justify this recognition. The data heretofore reported have been obtained largely from observations made on men during and following the performance of such types of work as running in place or on a treadmill and pedalling a stationary bicycle. Such activities are suitable for laboratory studies, since the work done can be measured fairly easily and accurately, the external environment can be reasonably well controlled and the nearness of the subject to fixed apparatus facilitates the observation of many reactions. The results obtained in the investigation of these restricted and somewhat artificial activities may well serve as a basis of comparison and a means of control in the study of other freer and more natural activities whose variety offers greater inherent interest and potential value and which are, therefore, more desirable in an ideal physical education program.

There is, however, little experimental evidence fundamental to the analysis of desirable program elements from the standpoint of organic demand, or by inference from the standpoint of organic development or of excessive strain. Similarly, investigations concerned with the reactions of girls and women to activity are few in number. It seems, therefore, that the application of principles, developed in the study of the physiology of exercise, to the physical activities of girls and women is of para-

* This study was aided by a grant from the Board of Research, University of California.

mount importance in affording a factual basis for the wise selection and adaptation of activities in the physical education program.

It is the purpose of this paper to present the methods of investigation used and the results of a study of certain physiological reactions of college women to measured activity. It is hoped that, eventually, from similar investigations, there will be developed norms of reactions which will form a valuable basis for comparison in the evaluation of activities and in the assessment of the needs and capacities of individuals.

The reactions studied are those related to the functions of circulation and respiration since every change in activity of the individual is accompanied by adaptive changes in these two systems. It has been clearly shown by Hill and his associates† [1, 2] that the energy requirement or metabolic cost of an activity is measured by the excess O_2 consumed during the performance and in the recovery from work, over that used during an equal time by the individual at rest. Determination of oxygen consumption is essential also in the study of the maximum oxygen debt tolerated and of the maximum external work done and maximum oxygen utilization during the "steady state." These three functions have been shown by Hill *et al.*,[3] Schneider,[4] and Bock *et al.*[5] respectively to be associated with the capacity of the individual for muscular work.

The total volume of the pulmonary ventilation, which is, except in severe exertion, roughly proportional to oxygen consumption[5] and therefore an approximate measure of the demands made upon the individual, must be measured in the course of the determination of oxygen used, and these results are also reported. Total pulmonary ventilation has also been used by certain investigators in estimating the capacity of cardiac patients. In an attempt to measure cardiac function by the degree of dypsnea produced by a standard activity, Cullen *et al.*[6] considered the ventilation index, $\frac{\text{Ventilation}}{\text{Vital Capacity}}$, as a fairly accurate expression of respiratory distress. Harrison and his associates[7] regard the ventilation index as a better guide in estimating cardiac function than other tests.

Increase in respiratory rate is a common and familiar accompaniment of activity. According to Schneider and his associates,[4, 8] there is a linear relationship between frequency of breathing and load of work, up to the crest load when the frequency of breathing augments excessively. They also showed that the time required for the breathing to return to its pre-exercise level is determined by the severity and duration of the exertion.

† Numbers refer to bibliography at end of article.

The function of the circulatory system in the transport of oxygen and nutrient substances to and of fatigue products away from the tissues, makes the study of the system imperative in any investigation concerning the adjustment of the body to the demands of external work. It would be desirable to study the circulation in all those aspects which have been shown to be involved in this adjustment. Techniques have been developed for the measurement of changes in the chemical constituents and in the formed elements of the blood, variations in cardiac size and conduction and in the volume of the circulating blood. However valuable such observations might be, they could be made in the study of activities outside the laboratory only with difficulty. In addition to the limited potential use of such methods in the analysis of the more complex activities of the physical education program, technical facilities for such investigations in our laboratory are not at present available.

The demands of an activity upon the circulatory system of the individual are reflected also in changes in the frequency of the heart beat and in the pressure of the arterial system during systole and diastole of the heart. Many studies have been made of these changes in relation to activity. It is doubtful whether measurement of the latter can be made with complete reliability. Measurement of the former, also, during many activities is limited and extremely difficult. However, the techniques of investigation of pulse rate and of systolic pressure at least are available and quite adaptable to the study of the recovery period following activity, either in or outside the laboratory. The results of observations of these two functions, as well as that of diastolic pressure, are included in the present report.

HISTORICAL

No attempt will be made to give a complete survey of the literature. Very good and extensive bibliographies are to be found in the recent excellent texts and review articles on the physiology of exercise. However, certain studies, either typical or unique, concerned with (1) the energy requirements or the circulatory effects of complex activities, (2) the reactions of girls and women, or (3) the limits of reaction or activity heretofore observed, will be mentioned briefly.

One of the earliest investigations of the energy requirements of women was made in 1919 by Greenwood, Hodson, and Tebb,[9] who measured the metabolic cost of various forms of industrial work. Further studies involving different kinds of work were made by Bedale[10] in 1924 and by Cathcart *et al.*[11] in 1927, as well as by a number of German workers whose contributions are summarized by Atzler.[12]

In a very extensive survey of the energy expenditure of school children Bedale[10] determined the metabolic cost, to boys and girls from 8 to 17 years old, of about 25 different "occupations" including such activities as football, cricket, gardening, gymnastics, violin and piano

practice, workshop and handcraft activities. Group rather than individual records were used in evaluating the cost of various activities to compensate in part for the lack of standardization of the activity. More than 800 experiments were made, in the course of a year, under natural rather than artificial conditions, the entire project having the support and cooperation of the school heads as well as of the 110 children who volunteered as subjects. It is most unfortunate that this admirable study, of such potential value in the physiological analysis of activities, was made before the meaning and importance of oxygen debt was recognized.

Smith and Doolittle[13] found that the energy expenditure of women during horizontal walking was of the same degree as that of men, determined by Smith.[14] The energy metabolism of women while ascending and descending stairs, as well as during horizontal walking, was determined by Benedict and Parmenter.[15] The magnitude of the oxygen debt was measured in only a few cases by the latter authors, although they recognized and discussed the importance of the "after-effect." The energy required per vertical kilogrammeter averaged 12 gram calories in ascent and 3.9 in descent. The net mechanical efficiency of ascent was computed to be 25 per cent.

Lowsley[16] studied the effects upon the circulation of men of various forms of complex activities including swimming, tennis, wrestling, running, and others. These activities were classified into five groups: moderate, rapid, vigorous, fatiguing, and exhaustive. His results, supported in general by many subsequent workers, were as follows: (1) all prolonged exercise, causing rise in pulse rate, causes a rise in systolic, a smaller rise in diastolic and a rise, therefore, in pulse pressure; (2) in all types of exercise studied, there is a subsequent subnormal phase of all three pressures. He suggests that the subnormal phase, more prolonged following rapid activity, is indicative of overstrain.

Fifty-four women were subjects of an investigation by Hartwell and Tweedy,[17] who recorded the pulmonary ventilation, respiratory rate, systolic pressure, and pulse rate at rest and immediately following the exercise of running once up and down stairs. The stairs were 11¾ meters in height, the average weight of the subjects was 61 kilograms, and the time consumed about 45 seconds. In a recent study by Prosch,[18] the effect of several types of complex activity upon the heart rates of young women was reported.

"Oxygen debt" has been defined by Hill [1] as the amount of oxygen used, in excess of the resting level, during the period commencing at the moment exercise ends and ending when recovery is complete, that is, when the oxygen intake has returned to its resting level. The largest oxygen debts are produced by severe exercise for short periods. Maximum values of .088 to .216 liters per kilogram of body weight, with the subject breathing atmospheric air, are reported by Hill.[3] Two of these

determinations, giving values of .088 and .104, were made on women. An oxygen debt of 18.6 liters, .266 per kilogram, has been reported for a highly trained young man breathing an air mixture rich in oxygen.[3]

A "steady state" is maintained when lactic acid formation is balanced by lactic acid removal. The limits of exertion during the "steady state" are therefore fixed by the maximum O_2 intake of which an individual is capable. Hill [3] reports a maximum O_2 intake by a well-trained man of four liters per minute. Values of two to three liters per minute are reported by Hill [3] and Bock and his associates[5] for men during work on a bicycle ergometer, and running in place and on a treadmill.

"Crest-load," as discussed by Schneider,[4] is equivalent to the maximum work done by a subject while maintaining a steady state. He reports values for the "crest-load" of 6,000–9,000 foot pounds per minute, the work being done by a man on a bicycle ergometer.

EXPERIMENTAL

Subjects.—The fourteen subjects used in this study were students at the University of California at Berkeley during the college year 1934–35. (See Table I.) The age range was from seventeen to twenty-two years, and all college classes from freshman to graduate were represented. Ten of the subjects were selected at random from students who have been granted Federal Aid. Analysis of the activity history, obtained by personal interview, showed a wide range and variety of interest and participation in physical activities during the elementary, secondary, and college periods. Three of these ten students were majoring in physical education. Four other students, all physical education majors, on whom certain observations were made were chosen especially for another related study.

TABLE I

SUBJECTS—PHYSICAL DATA

Subject	Age (years)	Class	Height (inches)	Weight (pounds)	Vital Capacity (liters)
I	20	Sophomore	61.3	116	2.0
II	21	Senior	62.9	109	3.3
III	17	Freshman	60.9	122	2.6
IV	19	Sophomore	63.5	135	2.6
V	20	Junior	64.8	136	3.7
VI	19	Sophomore	61.6	111	3.0
VII	21	Junior	67.0	145	3.7
VIII	18	Sophomore	64.0	129	3.7
IX	20	Sophomore	65.9	129	3.6
X	20	Junior	67.2	150	3.6
XI	22	Graduate	67.0	147	3.1
XII	20	Freshman	58.8	107	2.4
XIII	21	Junior	64.0	107	2.9
XIV	20	Senior	62.1	157	3.2

Daily individual records of sleep, exercise, diet, menstruation, and illness or any other condition of strain were kept during the first semester. Except in the case of Subject III, whose dietary habits were very irregular and whose energy intake was low, according to accepted standards, no unusual data were reported. Detailed analysis of these records as factors affecting the individual's response to activity has not, as yet, been attempted.

Procedure and Methods, General.—Determinations of basal metabolism were made in duplicate on successive days to serve as controls. Observations were made of respiratory rate, pulse rate, and systolic and diastolic pressures immediately before and after the metabolism tests, while the subject was connected with the apparatus. An average of from five to ten determinations was used as the "basal" for each function. Observations of respiratory and circulatory reactions were made also in four series of exercise experiments, three involving work performed on a calibrated bicycle ergometer, and one consisting of stepping up and down a stool. It was not possible to include all subjects in every series. In each exercise experiment, the subject rested, lying quietly, for thirty to forty-five minutes, after which a metabolism test was taken; she then mounted the bicycle, or stood in the stair-stepping series, and as soon as the pulse rate had reached a constant minimum after this mild exertion, another metabolism test of ten minutes was taken. These values were used as the basis for calculating the metabolic cost of the activity in the particular experiment. Observations were made during a recovery period of thirty minutes following moderate activity and of fifty to sixty minutes following the most strenuous exertion, with the subject in a reclining position. All reactions involved in attaining this position are included in the first recovery period.

Preliminary trials, on previous days, were given in both basal and exercise determinations to accustom the subjects to the apparatus and to the technique of the activity. All experiments were conducted in a well-ventilated, reasonably quiet room. Except in a few cases, the subjects were not in a post-absorptive state for the exercise experiments.

Methods.—In the determination of respiratory metabolism, the subject was equipped with a nose clip and a mouthpiece with double respiratory valves. The expired air was collected in a series of hundred-liter Douglas bags. Tests for leaks around the nose and mouth of the subject were made by means of a mirror, during collection in each bag. Duplicate samples of the expired air were withdrawn into glass tubes over mercury and stored under pressure until analysis in a Haldane-Henderson analyzer. Analysis of room air giving accepted values was made previous to the analysis of each series of samples. Expired air samples were analyzed in duplicate or triplicate with an allowable error of .05 per cent for O_2 and .03 per cent for CO_2. The volume of the ex-

pired air was measured by means of a dry meter, which had been calibrated against a wet meter in the meter testing laboratory of the Pacific Gas and Electric Company. A thermometer was placed in the outflow tube. Barometric pressure readings were taken from records made available through the courtesy of the Geography Department of the University. Carpenter's tables were used for correction and conversion factors in all calculations. Since with this technique, the variation in the basal metabolism for each individual was, with one exception, not more than 5 per cent, the reliability of the method was accepted as satisfactory.

Respiratory rate was counted and recorded by a student assistant who was equipped with a stop-watch and a writing board. Determinations were made by visual inspection of movement of the chest or abdomen or by listening to the sound made at the inspiratory valve. These observations were made by several different students, all of whom had preliminary practice.

The pulse rate was also counted and recorded by a student assistant equipped with a stop-watch and a writing board. Determinations were made by palpation of the radial artery. All assistants had preliminary practice in the technique and each made five or more observations during the preliminary rest period and during the sitting or standing period. In a few cases, a permanent record of the pulse rate was made on a recording polygraph. Agreement between the results of the two methods was very close.

Determination of systolic and diastolic pressures was made by three different student assistants, using a mercury sphygmomanometer and the auscultatory technique. Each assistant had considerable practice and in preliminary tests, with the subject resting, showed an agreement of three mm. or less with the author. Final cessation of sound, the so-called fifth phase, was used as the criterion of the diastolic pressure, since its reliability with the observers seemed more satisfactory. Each student had a writing board to record her observations; a stop-watch was in her line of vision.

In the determination of all these reactions, the methods used were chosen with a view to their adaptation in the study of the more varied and complex activities of the physical education program. For this reason the use of large pieces of fixed apparatus was avoided, at the expense of graphic records.

The bicycle ergometer used was equipped with an electric brake, whose resistance could be varied and was calibrated directly in small calories for various speeds and loads. The attempt was made in preliminary experiments to determine the loads to which the reaction of the subject was general rather than localized in the legs. Heavy loads were shown to be less suitable and variation in work done was effected largely through change of speed.

In the stool-stepping series, results of preliminary experiments indicated that a height of thirteen inches was most satisfactory in insuring the lifting of the entire weight of the body and at the same time permitting a reasonable ease of performance. The work done, the product of the body weight times the height of the step times the number of steps, was first calculated in foot-pounds and then converted into calories for comparison with the results of other series.

A metronome was used to regulate the speed of action in both bicycling and stair-stepping. The speed of bicycling for a given amount of work is, of course, equal for all subjects. The rate of stepping for equivalent work varies with the body weight, and was calculated for each subject previous to the experiment, and the metronome set accordingly.

An unexpected difficulty arose in the inability of the various subjects to keep time with the metronome, in spite of considerable preliminary practice. The work, therefore, varies with each subject. In many cases, but not all, failure to pedal or step at the rate set was due apparently to fatigue. Although it seems very probable that this source of variability might be adequately controlled in experiments with apparatus similar to a treadmill, no satisfactory means of overcoming this difficulty with the present forms of activity have been found.

Since the work actually done by each subject varied, comparison of individual reactions is very inconclusive. It is planned, in future experiments, to attempt to produce certain definite reactions in the individual, namely, limit of oxygen debt tolerated and maximum oxygen consumption during "steady state" and to measure the work done by the individual for each reaction. It is hoped that this line of investigation may yield results more satisfactory for analysis and comparison.

In two of the present series of experiments it is believed that these physiological reactions were approximated and the results of these experiments alone will be reported at this time.

RESULTS AND DISCUSSION

The results of observations made under basal conditions are shown in Table II. The basal metabolic rates, calories per square meter per hour, are, except for Subject II, somewhat low according to the standards of Boothby and Sandiford. It is possible that the extreme familiarity of the subjects with the apparatus and technique contributes to the low values found. In extensive basal metabolism studies on five subjects, thoroughly accustomed to the experimental procedure, Griffith and his associates,[19] obtained average values ranging from 6 per cent to 16.2 per cent below the Aub-Dubois standards, which are 1 to 4 per cent above those of Boothby and Sandiford.[20] The preliminary rest period for our subjects was usually longer than the thirty-minute period ordi-

narily used. Some of the subjects almost went to sleep during the test. Also, it must be noted that although routine analyses of room air gave consistent values for O_2 of 20.93 ± .03 per cent, alcohol checks were never run. This is a possible, but not probable, source of error. Further studies of basal metabolism are now in progress.

Values for respiratory rate, heart rate, systolic and diastolic pressures vary considerably among the various subjects. There are, however,

TABLE II

METABOLIC RATE, RESPIRATORY AND CIRCULATORY REACTIONS, WITH SUBJECTS IN BASAL CONDITION

Subject	II	III	IV	V	VI	VII	VIII	IX	X	XI	XIII
Basal metabolic rate (calories per square meter per hour)	36.77	31.29	33.09	30.72	30.56	32.69	31.51	32.98	33.13	31.01	30.98
O_2 consumption (cc. per minute)	180	166	187	176	158	218	176	191	205	188	161
Pulmonary ventilation (liters per minute)	3.52	3.99	4.25	4.87	3.82	4.94	4.43	4.28	4.49	4.51	3.36
Respiratory rate (per minute)	12.0	14.5	11.0	15.0	14.5	10.5	14.0	7.5	12.0	10.0	*
Pulse rate (per minute)	84	59	67	49	71	61	56	71	55	63	58
Systolic pressure (mm. Hg.)	117	107	96	104	109	108	107	118	94	109	88
Diastolic pressure (mm. Hg.)	67	66	59	65	67	70	60	82	60	73	56
Ventilation Index†	1.07	1.53	1.63	1.32	1.27	1.36	1.20	1.19	1.25	1.46	1.16
Basal metabolic rate correction § (per cent)	+1	—17	—9	—16	—16	—10	—14	—10	—9	—15	—15

* Respiratory rate markedly irregular during all resting determinations.

† Ventilation Index = $\frac{\text{pulmonary ventilation for one minute}}{\text{vital capacity}}$

§ According to standards of Boothby and Sandiford.[20]

few extremely high or low values. The systolic pressure of Subject XIII is low, and, according to her own report, has always been so. This same subject exhibited, consistently, such marked irregularity of respiratory rhythm under basal or resting conditions, that it seemed unjustifiable to record an average value. This irregularity, less pronounced in exercise experiments, may have been induced by the unnatural mouth breathing necessitated by the apparatus. It was not, however, due to lack of familiarity or preliminary trials with the apparatus, and apparently was not associated with any mental or emotional disturbance. The respiratory rate of Subject IX is somewhat low.

In Tables III*a* and III*b* are presented, respectively, the respiratory data during work and recovery, and the circulatory data of recovery from moderate work on the bicycle ergometer. Graphs of typical individual records are shown in Figures 1*a* and 1*b*. Respiratory measurements of oxygen consumption and pulmonary ventilation are expressed,

TABLE III*a*

RESPIRATORY REACTIONS DURING AND FOLLOWING WORK OF MODERATE INTENSITY ON BICYCLE ERGOMETER

Subject	II	III	IV	VI	VII	VIII	IX	X	XI	XIII
Duration of work (minutes)	15	15	15	15	15	13	15	15	15	15
Total work done (calories)	11,780	12,865	10,000	11,625	12,120	14,460	12,035	11,780	10,840	11,875
Work per minute (calories)	785	858	667	775	808	1,112	802	772	723	792
Total excess O_2 over resting (cc.)	7,765	7,520	9,575	7,660	9,115	10,291	8,760	8,605	7,945	7,890
O_2 debt—excess O_2 of recovery (cc.)	725	580	1,575	600	955	1,375	775	770	820	690
O_2 debt										
Total excess O_2	.094	.077	.165	.078	.105	.133	.088	.089	.103	.087
Gross mechanical efficiency (per cent)	19	22	10	20	15	15	18	18	17	18
Duration of recovery* (minutes)	5	5	20	5	5	30+	5	5	5	13
O_2 debt (liters per kilogram)	.015	.011	.026	.011	.015	.024	.013	.011	.012	.014
Maximum O_2 consumption during work (per cent of resting)	319	382	366	359	354	497	354	387	346	394
O_2 of first recovery† (per cent of resting)	163	160	173	165	175	194	167	175	170	167
Average O_2 consumption during work (cc. per minute)	700	686	788	702	816	907	769	750	763	680
Maximum pulmonary ventilation during work (per cent of resting)	337	346	317	329	337	460	309	353	309	344
Ventilation index § during work	5.55	6.65	6.81	5.29	4.29	5.28	3.91	4.56	5.68	4.91
Pulmonary ventilation of 1st recovery period (per cent of resting)	198	175	183	178	194	204	166	193	157	179
Ventilation index of 1st recovery §	3.26	3.38	3.93	2.85	2.47	2.35	2.09	2.50	2.89	2.56
Maximum respiratory rate per minute during work	25	25	21	24	16	19	8	17	17	
Maximum increase of respiratory rate per minute over resting	13	9	9	8	6	5	1	6	7	

* O_2 consumption within 5 per cent of resting level.

† First recovery period of five minutes duration.

§ Ventilation Index $= \frac{\text{pulmonary ventilation for one minute}}{\text{vital capacity}}$

TABLE III*b*

CIRCULATORY REACTIONS FOLLOWING WORK OF MODERATE INTENSITY ON BICYCLE ERGOMETER

Subject	II	III	IV	VI	VII	VIII	IX	X	XI	XIII
Duration of work (minutes)	15	15	15	15	15	13	15	15	15	15
Total work done (calories)	11,780	12,865	10,000	11,625	12,120	14,460	12,035	11,780	10,840	11,875
Work per minute (calories)	785	858	667	775	808	1,112	802	772	723	792
Systolic Pressure (mm. Hg.)										
Maximum pressure	138	132	128	130	134	128	140	120	120	112
Maximum increase*	+19	+20	+24	+22	+22	+20	+10	+12	+14	+14
Increase at 6th minute of recovery.	+5	0	+12	+14	+6	+10	0	+8	+4	+6
Increase at 30th minute of recovery	−3	+2	+4	+2	+6	+10	−4	0	+2	+4
Increase at time of complete O_2 recovery	+5	0	+3	+14	+6	+10	0	+8	+4	+2
Duration of recovery to 5 mm. Hg. (minutes)	6	5	6	13	20	30+	4	10	4	6
Diastolic Pressure (mm. Hg.)										
Minimum pressure	70	76	60	36	66	58	70	56	60	58
Minimum increase*	0	+2	0	−20	−2	−4	+4	−14	−6	−4
Increase at 6th minute of recovery.	+2	+6	0	−9	+4	−4	+4	−10	+2	−1
Increase at 30th minute of recovery	−4	+6	+5	+10	+4	+4	+12	0	0	−2
Increase at time of complete O_2 recovery	+2	+2	+4	−9	+4	−2	+4	−10	+2	−2
Duration of recovery to 5 mm. Hg. (minutes)	0	0	0	17	0	0	0	9	2	0
Pulse Rate (per minute)										
Maximum rate....	96	102	103	115	79	93	99	97	82	102
Maximum increase*	+12	+18	+29	+31	+23	+37	+23	+29	+8	+46
Increase at 6th minute of recovery.	−1	+4	+17	+12	−7	+1	+13	0	+9	+3
Increase at 30th minute of recovery	−6	−2	0	−1	0	+6	+12	−2	−15	+3
Increase at time of complete O_2 recovery	−1	+4	+7	+12	−4	+6	+13	0	−9	+3
Duration of recovery to 5 beats per minute	1	5	25	11	2	5	30+	2	1	4

* In Tables III*b* and IV*b*, "increase" is in relation to pre-exercise resting level.

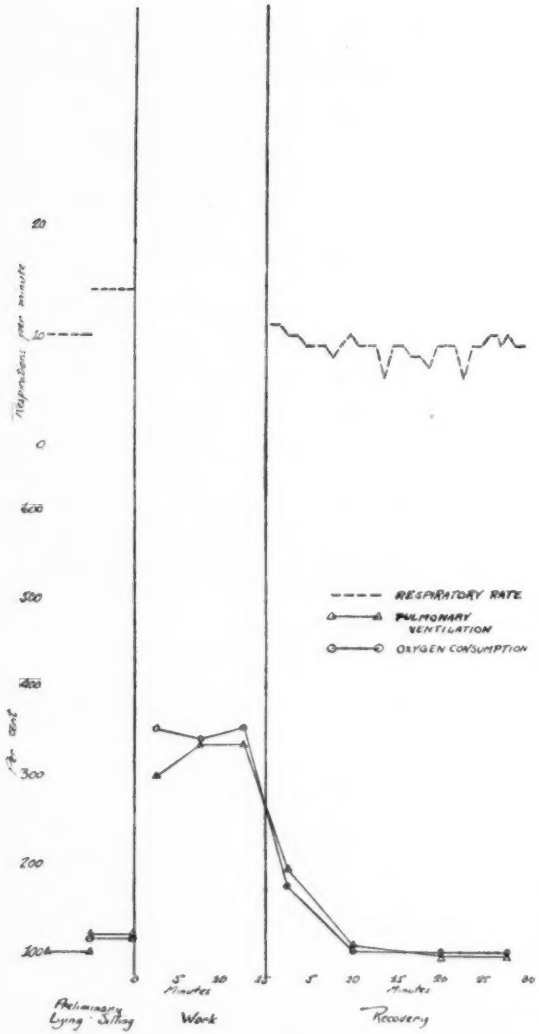

FIGURE Ia.—Respiratory reactions during and following work of moderate intensity on bicycle ergometer—Subject VII.

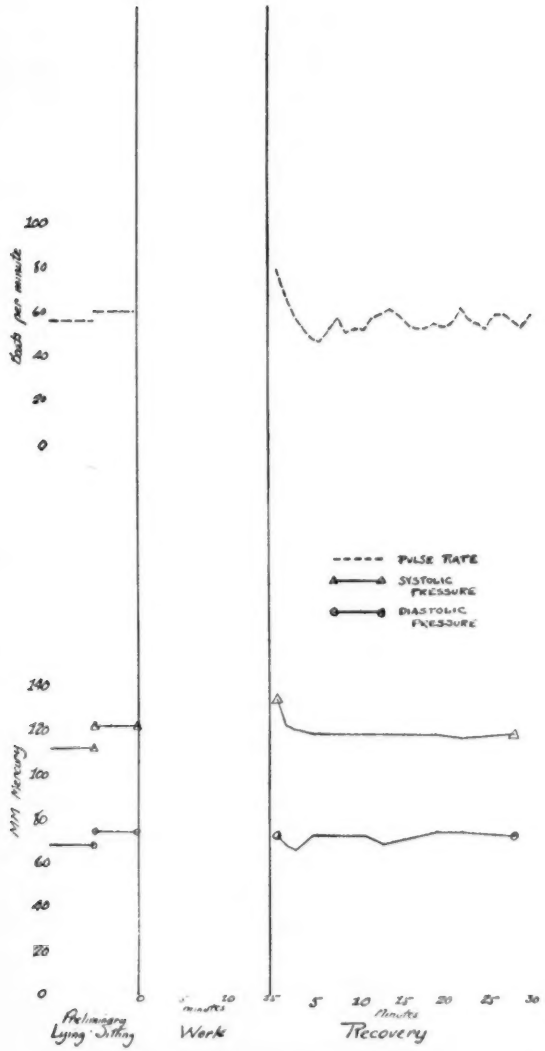

FIGURE 1*b*.—Circulatory reactions folowing work of moderate intensity on bicycle ergometer—Subject VII.

relatively, as per cent of the value determined during the pre-exercise metabolism period. Other measurements, respiratory rate as well as data for circulatory functions, have not been shown to bear a constant relationship to the physical proportions of the subject. Absolute figures for these measures are therefore used, and are later discussed in relation to increase or decrease over the values observed in the pre-exercise period. The theoretical work was 806 calories per minute, the pedalling speed being 76 strokes per minute and the metronome set at this rate for all subjects. The work actually done varied between 667 and 1,112 calories per minute. In this series of experiments, a preliminary working period of 2 minutes, at the same rate, was given in order that the level of metabolism characteristic of the activity might be established. After this preliminary period, the valve for the collection of expired air was turned, the subject pedalling continuously. Collection of expired air was made for 3 successive 5-minute periods (length of first period for Subject VIII was 3 minutes) during work and for 4 recovery periods of 5, 10, 10, and 5 minutes respectively.

It is believed that in this series of experiments, a "steady state" was approximated. The proof of a true steady state requires the demonstration of a constant lactic acid concentration in the blood, or the demonstration of the equivalence of oxygen requirement and oxygen intake. Specific evidence for either of these conditions is not available in the data. However, a small O_2 debt, the ability of the subject to continue the activity over a long period of time, constancy of rate of oxygen consumption and of pulmonary ventilation are characteristic of the "steady state." Excessive ventilation, that is, a decreased ratio of oxygen consumption to total ventilation, is characteristic of an overload, indicating that the effort is too great for the maintenance of the "steady state."

Since oxygen demand precedes oxygen utilization, there is always a slight lag—this is not a true oxygen debt but represents the decreased oxygen usage while the steady state is being reached. This excess oxygen of the recovery is small and is used very early in the recovery process. In this series of experiments, the oxygen debts for all subjects were small (580 to 1,575 cc.), the excess oxygen of recovery being 7.7 to 16.5 per cent of the total excess. Recovery was complete within five minutes in seven out of ten cases.

In nine of the subjects, average minute-ventilation for the last five-minute period was higher than for either of the preceding periods of work, although the increment was small. In one subject the minute-ventilation was constant throughout the entire period. Oxygen consumption increased slightly in successive five-minute periods for five subjects. In one subject, the oxygen consumption per minute was constant for the last two periods, and for all other subjects the consumption of oxygen decreased during the last period.

These data, together with the subjects' own estimation of their ability to continue for a longer period, are offered in support of the belief that a "steady state" and perhaps the maximum work possible during such state, were approximated. The evidence is suggestive, however, and not conclusive. Further experiments, outlined somewhat differently than in the present investigation, must be made to establish this condition accurately.

If this assumption is granted, with due reservations, certain comparisons of the results of this study with those previously reported may be of interest. The work done varied between 667 and 1112 calories per minute in comparison with 1944–2916 c/m, calculated for the crest loads of 6,000–9,000 foot-pounds per minute sustained by Schneider's subject. Judged from both respiratory and circulatory reactions, as well as from the marked deficit between actual and theoretical work, the subject doing only 667 calories per minute was taxed to a greater extent than almost any other subject. The reactions of Subject VIII, doing 1112 calories per minute, also indicate embarrassment.

The oxygen consumption per minute is likewise much less than the values reported for men: 680 to 907 cc. per minute for these young women in comparison with values of 2–3 liters per minute for men in poor or moderate training, and 4 liters for a well-trained man. It is true that the subjects of this study are capable of a higher rate of oxygen consumption, as shown in Table IV*a*, but for the reasons to be discussed later, the effort calling forth such usage could not be maintained, and the subjects were not presumably in a steady state.

There is a rise in systolic pressure of from ten to twenty-four mm. Hg. above the resting pre-exercise level. Recovery to within five mm. of the resting value requires from about five minutes, in the majority of cases, to over thirty minutes, in one case. In only two cases is there any significant change in diastolic pressure. Decreases of twenty and fourteen mm. Hg. respectively were observed in Subjects VI and X. An increase in pulse rate is observed in every instance, ranging from eight to forty-six beats per minute over the resting value. Recovery is complete within five minutes in all except three cases. The subnormal phase, commonly reported, is not always apparent in the present study.

Tables IV*a* and IV*b* include the results of observations made during the most vigorous form of activity so far studied. Graphs of typical results are shown in Figures 2*a* and 2*b*. The exercise consisted in stepping up and down a 13-inch stool at a rate of about 50 trips per minute, the number of steps varying inversely with the weight of the subject. The exact rate was calculated previous to the experimental period and the metronome set accordingly. The theoretical work to be done was approximately 1750 calories per minute in all experiments except that of Subject IX_1. It was discovered after that experiment that the metro-

TABLE IV*a*

RESPIRATORY REACTIONS DURING AND FOLLOWING VIGOROUS EXERCISE OF STAIR STEPPING

Subject	II	III	IV	VI	IX_1	IX_2	XI	$XIII_1$	$XIII_2$
Duration of work (minutes)	5	5	5	5	5	5	5	5	5
Total work done (calories)	7,430	7,898	7,399	9,089	11,627	8,635	9,028	9,493	8,915
Work per minute (calories)	1,486	1,580	1,480	1,818	2,325	1,727	1,806	1,899	1,783
Total excess O_2 over resting (cc.)	8,229	8,806	12,943	8,237	8,802	8,758	9,394	7,407	8,642
O_2 debt—excess O_2 of recovery (cc.)	2,580	2,903	2,852	2,756	2,590	2,320	2,448	2,440	2,000
O_2 debt									
Total excess O_2	.314	.330	.220	.334	.294	.265	.261	.329	.231
Gross mechanical efficiency (per cent)	9	8	7	9	12	**	**	13	13
Duration of recovery* (minutes)	17	40	50	30	24	16	7	19	23
O_2 debt (liters per kilogram)	.053	.053	.047	.052	.044	.040	.037	.050	.041
Maximum O_2 consumption during work (per cent of resting)	675	902	1,012	698	780	868	815	845	898
O_2 of first recovery † (per cent of resting)	305	275	295	336	218	300	343	232	245
Average O_2 consumption during work (cc. per minute)	1,402	1,379	1,642	1,336	1,473	1,525	1,650	1,307	1,580
Maximum pulmonary ventilation during work (per cent of resting)	977	1,030	1,080	1,090	856	825	1,068	1,200	1,012
Ventilation index § during work	14.45	17.80	18.11	17.08	8.92	9.75	18.80	14.35	15.70
Pulmonary ventilation of 1st recovery period (per cent of resting)	424	379	427	512	309	330	565	326	236
Ventilation index of 1st recovery	6.28	6.52	7.31	8.05	3.24	3.89	9.97	3.88	6.11
Maximum respiratory rate per minute during work	39	37	31	51	20	23	24		
Maximum increase of respiratory rate per minute over resting	27	25	19	37	13	16	15		

* O_2 consumption within 5 per cent of resting level.

† First recovery period of five-minute duration.

§ Ventilation Index $= \frac{\text{pulmonary ventilation for one minute}}{\text{vital capacity}}$

** RQ of total exercise and recovery periods greater than 1. Calorific equivalent of oxygen not determined.

TABLE IV*b*

CIRCULATORY REACTIONS FOLLOWING VIGOROUS EXERCISE OF STAIR STEPPING

Subject	II	III	IV	VI	IX_1	IX_2	XI	$XIII_1$	$XIII_2$
Duration of work (minutes)	5	5	5	5	5	5	5	5	5
Total work done (calories)	7,430	7,898	7,399	9,089	11,627	8,635	9,028	9,493	8,915
Work per minute (calories)	1,486	1,580	1,480	1,818	2,325	1,727	1,806	1,899	1,783
Systolic Pressure (mm. Hg.)									
Maximum pressure	230	150	138	158	150	180	156	142	200
Maximum increase*	+100	+38	+44	+54	+30	+56	+44	+54	+104
Increase at 6th minute of recovery	+41	+18	+6	+22	+5	+10	+22	+6	+12
Increase at 60th minute of recovery	0	−1	+2	+6	−4	−3	−5	+2	+6
Increase at time of complete O_2 recovery	+20	+1	+2	+3	0	+2	0	+6	+7
Duration of recovery to 5 mm. Hg. (minutes)	20	10	20	30	5	9	7	35	7
Diastolic Pressure (mm. Hg.)									
Minimum pressure	50	38	48	10	66		44	64	
Minimum increase*	−20	−28	−10	−54	−12		−14	+12	
Increase at 6th minute of recovery	−16	−16	−9	−32	−8	−8	0	+16	−9
Increase at 60th minute of recovery	−2	+3	0	+8	−2	+6	+13	+12	0
Increase at time of complete O_2 recovery	−10	+2	−1	0	−12	+4	+12	+15	−1
Duration of recovery to 5 mm. Hg. (minutes)	25	20	20	15	25	7	2	60+	6
Pulse Rate (per minute)									
Maximum rate	163	174	141	136	158	134	138	144	145
Maximum increase*	+71	+106	+65	+64	+86	+54	+74	+90	+81
Increase at 6th minute of recovery	+28	+39	+9	+43	+27	+21	+30	+39	+27
Increase at 60th minute of recovery	+19	+22	+1	+31	+7	+10	+12	+15	+14
Increase at time of complete O_2 recovery	+23	+24	−1	+39	+26	+18	+15	+32	+19
Duration of recovery to 5 beats per minute	60+	60+	20	60+	60+	60+	60+	60+	60+

* In Tables III*b* and IV*b*, "increase" is in relation to pre-exercise resting level.

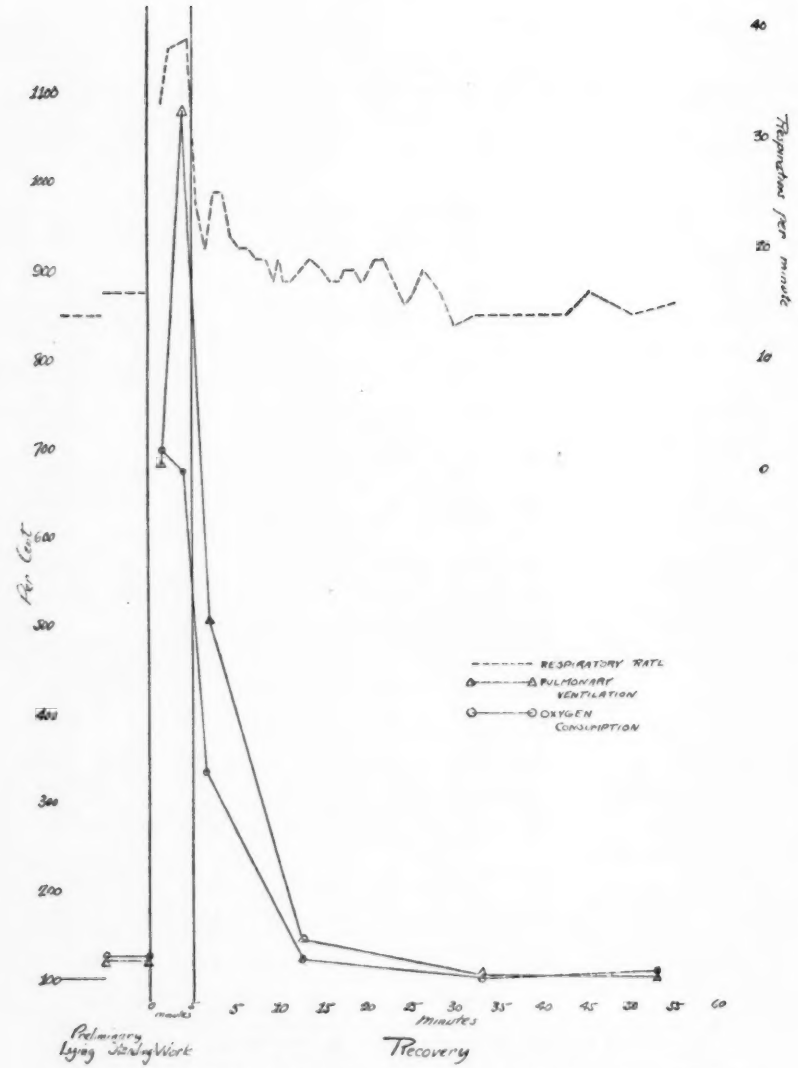

FIGURE 2a.—Respiratory reactions during and following vigorous work of stair stepping—Subject VI.

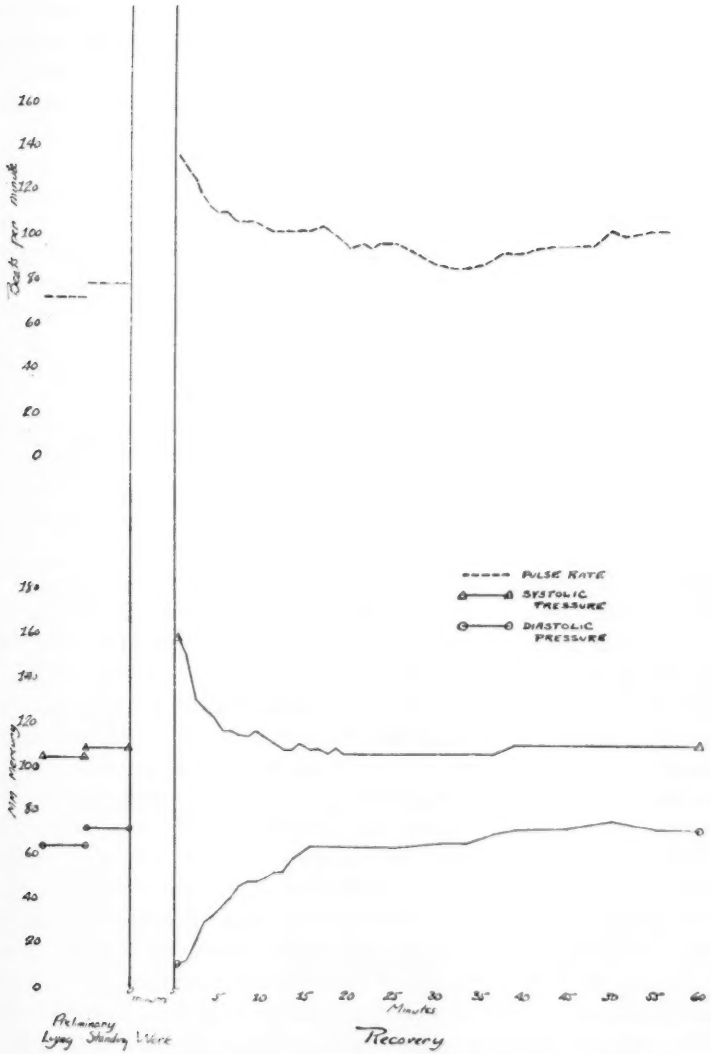

FIGURE 2b.—Circulatory reactions following vigorous work of stair stepping—Subject VI.

nome, either through an original error or a subsequent accidental change, was set at a higher rate than that calculated. No preliminary exercise period was allowed in this series of experiments; collection of expired air began simultaneously with the first step. The subject had, however, become adjusted to the demands of standing rather than lying. Collection was made in two bags during exercise periods of three minutes and two minutes, respectively.

It is believed that the subjects were, without exception, approaching their limits of exertion and that therefore the oxygen debts recorded approximate the maximum of which these subjects were capable under the experimental conditions. This belief is based largely upon subjective evidence, the judgment on the part of the author that the subjects were greatly fatigued and nearing exhaustion, and the feeling of exhaustion of the individual subjects. Further evidence of a more objective nature is offered by the inability of the subjects to maintain the pace set. The fact that different amounts of work were done and different oxygen debts incurred in each of the two experiments, for Subjects IX and XIII, must be noted in relation to the argument here presented.

The oxygen debts incurred are considerably less than those reported by Hill,[3] .037 to .053 liters per kilogram in contrast to his figures .088 and .104 for women, and .095 to .266 liters per kilogram for men. It is hoped, in future experiments, to determine whether these values can be increased for our subjects. However, the author on the basis of the present series seriously doubts the possibility and certainly the advisability of much greater effort on the part of our subjects.

The calculation of work done is made entirely from the ascent. Considerable energy is expended in descent—about 33 per cent of that of ascent in a continuous flight of stairs, according to Benedict and Parmenter.[15] However, it is not possible to calculate this in mechanical work done or in heat equivalents. The mechanical efficiency, as noted, is therefore, too low, but comparison of this value among the various subjects may be made.

The pulmonary ventilation increased from 825 to 1200 per cent of its resting value, while the rate of oxygen consumption increased to a lesser degree, 675 to 1012 per cent of the resting value. The value of the ventilation index ranged from 8.92 to 18.80 during work and from 3.24 to 9.97 during the first 5 minutes of the recovery period. Definite significance cannot as yet be attached to these values. However, they may serve as a valid basis of comparison in future studies. There was a marked increase in respiratory rate although no quantitative relationship to the work done can be established.

Average oxygen consumption during work varied from 1307 to 1650 cc. per minute, these values being considerably less than the oxygen intake of 2 to 4 liters per minute reported for men.[3, 5]

Maximum systolic pressures, observed during the recovery period, varied from 138 to 230 mm. Hg.; increases of 30 to 100 mm. Hg. over the pre-exercise value. Hartwell and Tweedy[17] found an average increase of 55 mm. Hg. in women, following less severe work, while Lowsley[16] observed an average increase of 39 mm. Hg. in young, well-trained men following exhaustive exercise.

Maximum pulse rates of 134 to 174 were observed in the present study, in comparison with 180, a value often accepted as a potential maximum rate, without curtailment of the minute output of the heart.[21] Increases over resting rates varied from 54 to 106. Recovery was, in all except one case, incomplete at the end of one hour, the final values being from 7 to 31 beats per minute above the pre-exercise level. This is a further indication of the severity of the work.

Hartwell and Tweedy[17] report an average increase of thirty-three beats per minute in non-athletic women, following less severe work, while Lowsley[16] observed an increase of fifty-four beats per minute following severe work by men.

In the present study, a decrease in diastolic pressure of from ten to fifty-four mm. Hg. was observed in every case except one, following severe activity. The effect commonly reported is an increase in diastolic pressure rather than a decrease. The fall in diastolic pressure, coincident with the rise in systolic and resulting in a great increase in pulse pressure, was obtained often also in other series not here reported. In two experiments, a similar fall in diastolic pressure was observed by another observer who had had a great deal of experience in taking blood pressures and who used the so-called "fourth phase" as a criterion. Whether this fall is the reaction to activity more vigorous than usually studied, or a reaction indicative of excessive strain, or poor condition of the subject, or is related to some aspect of adjustment in the resistance and pressure relations of the circulation not previously considered, or is due to the effect of the force of the beat upon the auditory discrimination of the observer must be determined in future experiments.

SUMMARY

The importance of analyzing activities from the standpoint of organic demand is discussed briefly. The meagerness of the data available for such evaluation is stressed.

Methods of investigation are presented in this preliminary study. The Douglas-Haldane technique was used in the determination of respiratory metabolism. In the study of the reactions of the circulatory system arterial blood pressures were determined with a mercury sphygmomanometer and the auscultatory technique; the pulse was counted from palpation of the radial artery.

College women, seventeen to twenty-two years of age, who were

qualified for regular physical activity by the University physicians, served as subjects. There was within the group a wide range and variety of interest and participation in physical activities. Observations were made under basal and resting conditions and during work and subsequent recovery periods.

Results of observation under basal conditions and in two series of exercise experiments are reported. One series involved work of considerable severity, in which it is believed the subjects approached their maximum effort while in the other a "steady state" was approximated.

The trend of the basal metabolic rates was toward low values. In the first exercise series, the maximum rate of O_2 consumption observed was 1650 cc/m, and the maximum increase was 10.12 times the resting level. The maximum oxygen debt was .053 liters per kilogram. Return of O_2 consumption to within 5 per cent of the resting level was complete in 50 minutes or less. The highest pulse rate (observed during the recovery period) was 174, an increase of 106 beats per minute. Except in one case, the pulse rate at the end of a 60-minute recovery period was 7 or more beats per minute above the resting level. A marked increase in systolic pressure, as high as 104 mm. Hg., was observed, the recovery period being 30 minutes or less. For all but one subject, the diastolic pressure immediately following exercise was below the resting level, the greatest fall being 54 mm. Hg. The pre-exercise level was regained in 25 minutes or less.

In the second series, work of moderate intensity was performed on a bicycle ergometer. Oxygen consumption reached 907 cc/m, 4.97 times the resting level. The maximum O_2 debt observed in the series was .026 liters per kilogram. Recovery was in most cases complete in 5 minutes. Systolic pressure, measured immediately after the exercise, increased as much as 24 mm. Hg. With two exceptions, no effect upon diastolic pressure was noted. The maximum increase in pulse rate was 46 beats per minute. Resting rates were re-established in most cases in 11 minutes or less.

The need for further work to establish norms of reaction to activity is emphasized.

ACKNOWLEDGMENT

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Evaluating Practices in Health and Physical Education

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PRACTICES in health education have moved gradually and far in the modern schools from the old academic study of physiology, anatomy, and hygiene. It is true that many health education practices of the present time have much traditional content that is taught with a fond hope that it may influence the hygiene of the child. The modern theory for health instruction is that knowledge of hygiene is defined in the lives of people, that the content is health habits and attitudes, that the method is the routine of daily life, and that its results are happier and healthier persons, according to Williams and Brownell.* It follows, then, that instruction in health touches the whole of living. Physical health, mental health, and moral health are only convenient and conventional phrases for referring to aspects of the whole of living that goes on in the organism. Modern health instruction is not restricted to studies of digestion, exercise, air, sleep, or such states as tuberculosis, heart disease, and diabetes. It relates to ways of thinking; its scope is more broadly conceived to touch more of life and living.

Direct teaching of health is preferred by most health educators to incidental teaching. Incidental teaching, except for the unusual teacher, leaves health soon neglected or ignored. Incidental teaching should not be confused with correlation. If the plan calls for teaching health in connection with science, social studies, or other fields, there will be certain content to cover or known areas to investigate. In fact, correlation is to be recommended in many instances for its economy, integration, and reinforcement of health and knowledge and attitudes. Methods and practices, however, should be closely knit with materials, content, and pupil experiences.

Some trends in health and physical education, as they have been summarized by P. Roy Brammell of the National Survey of Secondary Education, denote average conditions in the nation.† He found that a little more than half the schools have outlines of study for health instruction. In only one-fourth the schools is any effort made to measure results of health instruction, and many of these measures are superficial.

* J. F. Williams and C. L. Brownell, *The Administration of Health and Physical Education*, Philadelphia: W. B. Saunders Company, 1934.

† P. R. Brammell, *Health and Physical Education*. National Survey of Secondary Education Monograph No. 28, United States Office of Education, Bulletin No. 17, 1932.

In the field of physical education, Brammell reports that only a few trends based on data of his study can be given. The trend in the type of work offered in physical education has been for some time and still is away from calisthenics and formalized drill toward games and free play. Training of teachers is becoming more and more specialized, and the size of classes has increased. Physical education has not been subjected to a thorough program of testing in most school systems. Physical activities of pupils during out-of-school hours are becoming more and more a concern of health and physical education departments.

The modern schools represented in this study of newer-type practices have incorporated into their programs the most advanced trends noted by Brammell. Some of the schools are experimenting with new activities and methods of instruction. Out of such experimentation newer trends may develop for more general use.

Newer-Type Practices.—The physical education programs in the several newer-type secondary schools used in this study have been developed and administered to provide an equal opportunity for all boys and girls physically able to participate in seasonal indoor and outdoor athletic and recreational activities. These are used both in scheduled school-day and in after-school instruction. They include soccer, cross-country, field hockey, basketball, swimming, skating, ice hockey, wrestling, fencing, baseball, golf, tennis, volleyball, track and field, miniature yacht racing, archery, horseback riding, horseshoes, and hiking. While participation in these activities is optional, the enrollment of pupils uses all available school and community facilities. Interhome-room and interclass leagues are organized and conducted in many of the athletic activities throughout the year.

The physical education programs of the junior and senior high schools of one of the newer-type schools of this study have for a long time comprised informal activities in the gymnasium and on the field adapted to pupils' interests and needs. The activities are for the most part built around gymnastic skills and athletic skills of interest to normal boys and girls. Calisthenics and formalized class drill have been eliminated. In their place, for example, small groups of boys engage in such gymnastic skills and activities as forward roll, backward roll, head stand, running high dive, handspring, rope climb, spinning wheel, rings, and so on. Athletic skills are practiced by small groups of boys and include such activities as dropkick, placekick, forward pass, and punt in football; push pass, overhead pass, and hook pass in basketball; serve and return in volleyball; and start, high jump, broad jump, and shot put in track, and many others.

In a like manner gymnastic skills are achieved by girls by means of activities such as forward roll, backward roll, cartwheel, skipping, climb ladder, climb rope, bicycle exercise, and so on. Athletic skills for girls are

achieved by individual or small group participation in dropkick and placekick in speedball; chest throw, overhead throw, and hook pass in basketball; serve and return in volleyball and tennis; and so on.

The regular classes for both boys and girls do include some incidental group activities as dancing and games. However, the acquisition of gymnastic and athletic skills is largely individualized; that is, the pupil makes individual progress in achieving proficiency in specific skills. The skills are different for each grade and increase in difficulty from the seventh to the ninth grade. These specific skills are enumerated on goal sheets, one set of goals for boys and another set of goals for girls.

The aspects of social attitudes and knowledges which are concomitant elements in the process of group endeavor are not ignored. However, no formal attempt is made to measure them. All opportunities for the development of specific and general attitudes and habits in social relationships among pupils are utilized by the physical educators. Attempts are frequently made to correlate aspects of physical education with the natural sciences, especially biology and physics. The theory of levers as taught in physics is discussed in relation to muscular activity. All physical injuries are discussed when they occur by use of various charts, so that the pupil becomes better acquainted through a functional knowledge with structure of anatomy.

In order to build the physical education program around the needs of the children, the Rogers battery of physical capacity tests is administered in the Fall soon after the opening of the school. The tests are administered again in the Spring, usually in March. These tests serve three purposes, first to diagnose pupil needs and deficiencies, second to measure growth and strength, and third to classify pupils for intraschool games. It is by using the results of these tests as guides that a comprehensive program as well as individual programs for pupils is planned.

If a pupil is conscious of certain deficiencies, he may engage in various gymnastic and athletic activities to build himself to physical proficiency. Thus an interaction between the testing program and regular education activities is attained. By allowing the pupil to choose his games and exercises, the physical educator regards the pupil's interests. By directing these interests toward eliminating physical deficiencies, if any, the physical educator regards the pupil's needs.

Older-Type Practices.—The older-type practices in health and physical education are characterized by certain general factors. These are well known to practically all individuals who have attended the high schools of a decade ago and to a large number of present-day pupils. One of the characteristics is that the educational activities are largely composed of the more formal drills and calisthenics. Pupils are asked to

perform in unison some prescribed sets of exercises, as these are directed by counting or rhythmic accompaniment. Often expensive equipment by means of which individuals are taught certain physical tricks is installed in the school gymnasium.

Instruction in the sports in these older-type schools is limited almost exclusively to a chosen few pupils who have the time after school to engage in them, and who are more or less outstanding in physical powers and abilities. The physical education program of sports is thus an almost separate and extra-curricular activity of the school. The physical education program in these older-type schools usually is not adapted to the needs of the individual boys and girls. Quite frequently there are no means or instruments for ascertaining the abilities or disabilities of the pupils, hence no remedial program of a systematic sort. There is little correlation between the health instruction, if any, and physical education features of this program, and much less correlation with other areas of information and knowledge, especially the natural and biological sciences in the curriculum of the school.

In summary, then, the older-type school tends to stress formal drills in calisthenic exercises. There is little coordination of the various instructional activities which are supposed to contribute to the health and physical fitness of the pupils. This separate identity of different parts of instruction is especially noticeable in the lack of an integrated curriculum of health, physical education, and biological science.

Objectives of This Study.—The first major objective of this study was to discover what differences in P.F.I. might exist between pupils of the newer-type practices compared with the older-type practices. Another aspect of the study was to note at what seasons or times of the year the greatest gains in P.F.I. occurred. Other objectives were to make comparisons between the average P.F.I. of campers and non-campers; between pupils who are part-time job-holders and non-job-holders; between pupils of employed and unemployed parents. An analysis was made to see what correlations existed between the P.F.I. and such background factors as socio-economic status, home sports, school sports, camp sports, parents' nationalities, parents' occupations, hours of sleep, etc. These various findings are presented in the following tables and interpretations.

In order to make comparisons of individuals in this study upon a scientific basis, the pupils compared for different types of practices were equated upon the basis of age, height, weight, and socio-economic status. It was felt that these factors would be most directly related to any major differences which would occur in P.F.I. scores. Table I presents the comparison of equated boys under the newer-type and older-type practices. Table II presents the information on the equated groups of girls who were compared for newer- and older-type practices.

TABLE I

DATA FOR EQUATED BOYS UNDER NEWER AND OLDER PRACTICES

Factors	Schools	Pupils	Average Scores	S. D.
Age	Older.....	357	187.86 mo.	19.56
	Newer.....	357	187.78 mo.	19.68
Height	Older.....	357	69.92 in.	3.81
	Newer.....	357	66.52 in.	3.51
Weight	Older.....	357	125.80 lbs.	20.90
	Newer.....	357	125.80 lbs.	21.40
Socio-Economic Status	Older.....	357	53.12	16.72
	Newer.....	357	52.83	15.65

It will be noted in Table I that 357 boys in the newer-type schools were matched with 357 boys of the older-type schools. The average age was 187.86 months. The average height was approximately 66 inches for these equated groups. The average weight was 125.8 pounds. The standard deviations of these various factors were practically equal for the older- and newer-type schools. Thus it is apparent that the groups are very closely equated.

TABLE II

DATA FOR EQUATED GIRLS UNDER NEWER AND OLDER PRACTICES

Factors	Schools	Pupils	Average Scores	S. D.
Age	Older.....	109	185.38 mo.	15.68
	Newer.....	109	184.66 mo.	15.08
Height	Older.....	109	63.06 in.	2.60
	Newer.....	109	62.98 in.	2.28
Weight	Older.....	109	115.60 lbs.	16.00
	Newer.....	109	115.35 lbs.	17.20
Socio-Economic Status	Older.....	103	55.00	16.95
	Newer.....	103	50.45	14.40

In Table II data are presented for matched-pairs of 109 girls of the newer-type schools with 109 girls of the older-type schools. The average age was 185.3 months. The average height was approximately 63 inches for these equated groups. The average weight was 115.6 pounds. The standard deviations of these various factors are practically equivalent. The groups are closely equated.

Comparison of P.F.I. Scores for Equated Boys and Girls in Newer and Older-Type Schools.—After equating the boys and girls in the newer- and older-type schools, a comparison of the P.F.I. scores of these equated pupils was made. It was felt that this comparison would show what differences in P.F.I. might exist, and perhaps to what extent the different types of programs of health and physical education in the different type schools affected the physical fitness of the boys and girls, as measured by the Rogers battery of physical fitness tests. The com-

parisons between equated pupils in these schools are presented in Table III.

An inspection of Table III shows that the boys in the older-type schools had an average P.F.I. of 95.2, whereas the boys in the newer-type schools had an average P.F.I. of 103.4. A difference of 8.2 points exists in favor of the newer-type practices. This difference was found to be statistically significant. The girls in the older-type schools had an

TABLE III

COMPARATIVE P.F.I. SCORES FOR BOYS AND GIRLS UNDER NEWER- AND OLDER-TYPE PRACTICES

Subject	School	Pupils	Average P. F. I.	S. D.	Mean diff.	S. D. diff.	Ratio
Boys P.F.I. Score	Older...	357	95.20	22.52	8.20	1.62	5.06
	Newer..	357	103.40	20.46			
Girls P.F.I. Score	Older...	109	101.60	31.06	12.90	3.68	3.52
	Newer..	109	114.50	22.21			

average P.F.I. of 101.6. The girls in the newer-type schools had an average P.F.I. of 114.5. The difference between these two averages was 12.9. This difference also was found to be statistically significant.

It seems fair, therefore, to conclude that the newer-type practices, which were previously described, are more or less instrumental in affecting the average physical fitness of both boys and girls as measured by this test, in a fairly significant manner.

Seasonal Gains and Losses in P.F.I.—One of the most interesting analyses of the P.F.I. data is that of the gains at different seasons of the year. By examining Table IV the reader may observe that from

TABLE IV

SEASONAL GAINS AND LOSSES IN P.F.I. FOR TWO GROUPS OF BOYS

	Boys	Gains or Loss	S. D.	Mean diff.	S. D. diff.	Ratio
March to September	139	—5.64	10.93	13.41	1.40	9.58
September to March	139	+7.77	12.41			
March to October	47	—.99	12.20	5.81	2.54	2.29
October to March	47	+4.82	12.44			

March to September there was an average *loss* of 5.64 for 139 boys and that the same pupils showed a *gain* from September to March of 7.77. Another group of 47 boys had an average loss of .99 from March to October and a gain of 4.82 points from October to March.

These gains and losses at various parts of the year should be inves-

tigated with much more thoroughness than is possible in the present study. All that one may say to account for the loss in P.F.I. from March to September, and the gain from September to March is to guess about the probable causes. One plausible theory is that from September to March the pupils are under a more thorough and systematic program of health and physical education than they are from March to September, when the summer vacation intervenes. The systematic and probably more careful checking during the school year may produce a decided growth in the pupils as a group, whereas the lack of careful checking on systematic play and exercise during the summer may cause losses among pupils as a group.

Comparison of Campers and Non-Campers.—In the comparison of campers and non-campers one can observe from Table V that the boys who attended camp show a slight superiority in P.F.I. over those who did not attend summer camp. The campers had an average P.F.I. of 102.0; the non-campers 95.9. This is a difference of 6.1 points, in favor of the campers, but it is not statistically significant. Only 80 campers and non-campers could be equated by the matched-pairs technique in which age, height, weight, and socio-economic status were equal for both groups. With such a careful comparison, it seems that the trend here disclosed would probably be true if a larger number of cases were available for use.

TABLE V

COMPARISON OF CAMPER AND NON-CAMPER PUPILS FOR P.F.I. ADVANTAGE

	Group	Pupils	Average P. F. I.	Standard Deviation	Mean Diff.	S. D. Diff.	Ratio
Boys	Campers.....	80	102.00	24.31	6.10	3.69	1.65
	Non-campers.	80	95.90	22.34			
Girls	Campers.....	68	115.60	24.88	15.20	4.59	3.31
	Non-campers.	68	100.40	28.56			

The 68 matched pairs of girls who were equated on the basis of age, height, weight, and socio-economic status compared as follows: The campers had an average P.F.I. of 115.6; the non-campers of 100.4. The difference was 15.2, and this difference was found to be statistically significant.

Conclusions.—The tentative conclusion that may be stated is that pupils who have had camp experience will, as a group, usually possess an advantage in P.F.I. over similar pupils who have not had camp experience. The advantage is more significant for girls than for boys.

Part-Time Job-Holders and Non-Job-Holders.—We found that 148 of the boys included in our survey had part-time jobs in which they were engaged before or after school hours. We were able to equate these 148 with 148 non-job-holders by the matched-pairs technique. The

bases of the comparison were age, height, weight, and socio-economic status. The job-holders had an average P.F.I. of 94.60; and the non-job-holders of 95.9. This made a difference of 1.3 in average P.F.I. and the difference was not statistically significant. We found that 52 girls held part-time jobs and these were equated with 52 non-job-holders on the same bases as the boys. The average P.F.I. of the job-holding girls was 99.3. The average P.F.I. of the non-job-holding girls was 102.8. The difference between these is 3.5; and the standard error of the difference is 6.12. The difference between these two groups is not statistically significant.

TABLE VI

COMPARISONS OF P.F.I. FOR PUPILS WHO ARE PART-TIME JOB-HOLDERS AND NON-JOB-HOLDERS

	Group	Pupils	Average P. F. I.	Standard Deviation	Mean Diff.	S. D. Diff.	Ratio
Boys	Job-holders	148	94.60	21.96	1.30	2.49	.52
	Non-job-holders	148	95.90	20.89			
Girls	Job-holders	52	99.30	26.10	3.50	6.12	.57
	Non-job-holders	52	102.80	35.60			

Conclusion.—Although the pupils who do not engage in part-time jobs have a very slight advantage in P.F.I. over the pupils who have part-time jobs, this difference is so slight that it is negligible. The inference which may be drawn from these data is that the influence of part-time employment on P.F.I. is so slight that it makes no significant difference either for boys or girls.

Pupils Whose Parents Are Employed and Unemployed.—Although it is difficult to get any very definite information in some of the cases about the employment of some of the parents, data which were collected have been treated. A certain amount of confidence may be placed in these results, although caution is urged in their interpretation.

With the boys the P.F.I. for 64 whose parents were employed was 97.7; and the average P.F.I. of 64 matched boys, equated for age, height, and weight, whose parents were unemployed was 96.9. The mean difference is .78, which is not statistically significant.

With girls, 64 girls of employed and unemployed parents were matched in pairs on the bases of age, height, and weight. The average P.F.I. of the 64 girls whose parents were employed was 101.13; and the average P.F.I. of the girls of unemployed parents was 105.5. The difference between these is 4.37. But the standard error of the difference is 4.95, so the difference is not statistically significant.

Conclusions.—These results were somewhat contrary to those which one might have predicted or judged before the computations were made and the data were treated. There is no evidence here which would per-

mit any conclusion other than that there is little apparent difference in P.F.I. between the equated groups of boys and girls whose parents are employed and unemployed. Perhaps other bases of equating a group such as this would provide other results.

Comparison Between P.F.I. and Various Background Factors.—Some factors that are frequently assumed to have indirect relationships with the physical fitness of an individual are: socio-economic status,

TABLE VII

COMPARISONS OF P.F.I. FOR PUPILS WHOSE PARENTS ARE EMPLOYED AND UNEMPLOYED

	Group	Pupils	Average P. F. I.	Standard Deviation	Mean Diff.	S. D. Diff.	Ratio
Boys	Employed.....	64	97.69	21.49	.78	3.78	.21
	Unemployed....	64	96.91	21.28			
Girls	Employed.....	64	101.13	25.69	4.37	4.94	.88
	Unemployed....	64	105.50	30.10			

parents' occupation and nationality, and participation in various sports at the home, school, or camp. The correlations do indicate certain trends which might be used as bases for making further detailed studies. These data are presented in Table VIII.

TABLE VIII

COMPARISON BETWEEN P.F.I. AND VARIOUS BACKGROUND FACTORS (Boys and Girls Combined)

Correlation between P.F.I. and:	Pupils	Correlations
Socio-Economic Status.....	967	—.066
Parents' Nationality	570	.168 (eta)
Parents' Occupation.....	551	.095 (eta)
Home Sports.....	1979	.228 (eta)
School Sports.....	1379	.381 (eta)
Camp Sports	418	.183 (eta)
Hours of Sleep.....	568	.169 (eta)

Interpretation.—We note some rather interesting coefficients of correlation and correlation ratios in Table VIII. Socio-economic status, for example, has a negative correlation of .066 with P.F.I. This would indicate that the socio-economic status of the family has little influence on the P.F.I. The correlation ratio of parents' nationality and P.F.I. is also low, being about .17, but it does indicate a slight tendency for some nationalities to surpass others on P.F.I. tests. The P.F.I. correlates at about .10 with the parents' occupations but this is too low to be used for any prediction.

The correlation ratio in home sports, school sports, and camp sports are interesting. These relationships are all rather low and none of them

is particularly significant, except that they indicate that the participation in certain sports rather than others selects and develops pupils in physical fitness.

The hours of sleep correlates at only .17 with P.F.I., indicating a slight tendency that pupils having an hour or two more of sleep than others have a slightly higher P.F.I.

SUMMARY OF FINDINGS

From the data and discussions which have been presented in this study of the physical fitness index in its relationship with various factors, the following conclusions and inferences may be drawn:

1. Data on the physical fitness of boys and girls under the newer-type practices compared with the older-type practices show favorable and superior differences for the newer-type practices. The differences for both boys and girls are statistically significant.

2. Data provide evidence that pupils gain in P.F.I. during the school year, whereas they are liable either to lose or to show relatively little growth in P.F.I. during the summer months. One theory is that the systematic health program of the school does have a measurable effect upon the physical fitness index of pupils.

3. Another tentative conclusion is that pupils who have had camp experience will, as a group, usually possess an advantage in P.F.I. over similar pupils who have not had camp experience. The advantage is more significant for girls than for boys.

4. Although pupils who do not engage in part-time jobs have a very slight advantage in P.F.I. over the pupils who have part-time jobs, this difference is so slight that it is negligible. The inference which may be drawn from these data is that the influence of part-time employment on P.F.I. is so slight that it makes no significant difference either for boys or girls.

5. There is no evidence in this study which would permit any conclusion other than that there is little apparent difference in P.F.I. between the equated groups of boys and girls whose parents are employed and unemployed. Perhaps other bases of equating a group such as this would provide other results.

6. Social and economic factors have shown very slight relationships with P.F.I., although there is some tendency toward differentiation in terms of nationality.

7. There is some evidence that participation in certain sports rather than others selects and develops pupils in physical fitness.

8. Data show a tendency of pupils having an hour or two more of sleep than others to have a slightly higher P.F.I.

The Classification of Secondary School Boys for Purposes of Competition*

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With the publication of the *California State Manual of Physical Education* in 1918 came the formulation of a scheme for classifying high school boys into equivalent groups for competition in events of strength and skill. This classification scheme was based upon the earlier work of Reilly[1] and took into consideration the four factors of age, grade, height, and weight. From time to time during the past fifteen years, the scheme has been revised to better meet inaccuracies discovered by its use in the field, but no investigation has been conducted to determine how closely the plan approximates one set up by means of scientific procedures. For some years data on performances of boys in the Los Angeles junior and senior high schools have been collected and made available for the scientific determination of a classification plan which would show in true proportion the net influence of the factors of age, height, and weight upon performance in a wide variety of activities involving strength and skill. Grade was eliminated because of the high relationship which exists between age and grade, and because evidence has been brought forward to indicate that the information given by the factor of grade is taken care of by age, height, and weight.[2]

By means of simple and partial correlation techniques, partial regression coefficients have been computed for each of the factors of age, height, and weight in a large number of events. Ordinarily these coefficients would be used in a regression equation for predicting performance in a given event, knowing the three factors involved. In the particular equations to follow, the regression coefficients have been reduced to comparable quantities, and indicate the net influence which the factors have upon performance. Hence, grouping according to the

* A paper presented before the Research Section of the American Physical Education Association Convention, April, 1935, at Pittsburgh, Pa.

1 Frederick J. Reilly, *New Rational Athletics for Boys and Girls.* New York: D. C. Heath and Company, 1917.

2 Charles H. McCloy, *The Measurement of Athletic Power,* p. 90. New York: A. S. Barnes and Company, 1932. Dr. McCloy's study involving a scientific classification index gave impetus to further studies along this line, verifying his index.

formula will eliminate the specific influence of each factor in so far as it is humanly possible and practicable.

To be theoretically correct, we should classify boys for purposes of competition according to a different formula for each event because in no two events do the factors of age, height, and weight operate in the same manner. Obviously such a procedure would be impossible and it seems logical to believe that the classification formula to use is an average made up by grouping a large number of events into types or elements of athletic ability. Accordingly such a procedure was followed with the following results:

Running Index	$= 20A + 9.78H + 1.26W$
Jumping Index	$= 20A + 5.02H + 1.13W$
Throwing Index	$= 20A + 2.07H + 1.77W$
Weight and Strength Index	$= 20A + 5.48H + 1.99W$
Kicking Index	$= 20A + 1.41H + 1.87W$
Average of the five[8]	$= 20A + 4.75H + 1.60W$
Dividing by 10 the Best-fit Index	$= 2A + .475H + .16W$

It will be of interest to see how this formula compares with one which has been approximated from the plan used by the California Interscholastic Federation for classifying boys in competitive sports such as football, basketball, and track.

Taking samples of normal boys in grades nine, ten, eleven, and twelve, computing their coefficients from the C.I.F. classification plan, and averaging all four, we have

C.I.F. Classification Index $= 1.29G + .965A + .226H + .155W.$

Since, for all practical purposes, age and grade are closely related, we may combine them making the formula

C.I.F. Index $= 2.255A + .226H + .155W$

Reducing this formula to terms such that it may be compared with our Best-fit Index by making the age factor 2, we have

C.I.F. Index $= 2A + .200H + .1375W$

Best-fit Index $= 2A + .475H + .16W$

A comparison of these two indicates that, by scientific procedures, height is shown to be worth almost two and one-half times the value it was given in the empirical formula and that weight is more important by approximately 14 per cent than it is now considered.

The accompanying table has been made from the index $2A + .475H + .16W$. The exponent value for age is computed by multiplying the age in years by 2. Exponent 22, for example, really extends from 21½ up to but not including 22½. Thus 10¾ years will have an exponent

[8] The purpose of this index is for comparison with McCloy's Classification Index ($20A + 6H + W$), *op. cit.* In all formulas A refers to age in years, H to Height in inches, and W to weight in pounds. The data available for this study include approximately 20,000 performance records of boys in a wide variety of individual athletic events and were gathered in five different communities in southern California.

value of 21½ while 11 1/6 years will have an exponent value of 22⅓. Adding another month will make the age 11¼ which brings the exponent value to 22½ or 23.

Similarly 47 inches is the lowest height measure which will give an exponent value ranging below 22½, since 47½ inches gives an exponent value of 22.56. The multiplying factor for height is obtained from the formula as .475.

To obtain the exponent for weight, the actual weight is multiplied by .16. In the case of exponent 22 (21.5–22.49), the weight ranges, to the nearest pound, are 135–140; 134 lbs. will give us a lower value than 21.5 and 141 lbs. a higher value than 22.49.

The exponent limits for classes *F, E, D, C, B,* and *A* were chosen after a comparative study of the C.I.F. classification scheme and the new one, taking into consideration the division points under the C.I.F. plan and providing for a more equal distribution of classes (in point of number of boys) in the junior high school and in the senior high school. Predominating in the junior high school will be classes *F, E, D,* and *C* while in the senior high school will be *C, B,* and *A*.

It is interesting to note that the correlation coefficient between the present C.I.F. Classification Plan and the proposed index is extremely high, being $r = .960$. However, despite this high relationship, the Predictive Index of the C.I.F. Classification Plan in obtaining coefficients under the new scheme is .72, only ¾ of what it should be in a perfect relationship.

ACHIEVEMENT SCALES

Using this classification device, achievement scales in forty-five different events have been set up for secondary school boys and will be included in a manual now ready for publication.

The type of scale set-up is the same as that used in the elementary study.[4] Means and standard deviations were computed for each class and then smoothed. Using these smoothed means and standard deviations, the scales were set up according to the *equal-step interval* plan with a range of 3 standard deviations on each side of the mean. A score of 50 is the performance level at the mean, a score of 100 at 3 standard deviations above the mean, and a score of 0 at 3 standard deviations below the mean. Increments for each score increase were computed by dividing 6 times the standard deviation value by 100.

The following scales of the *100-Yard Run* and the *Running Broad Jump* will illustrate the general set-up of all scales.

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[4] N. P. Neilson and Frederick W. Cozens, *Achievement Scales in Physical Education Activities*. New York: A. S. Barnes and Company, 1934.

CLASSIFICATION PLAN FOR SECONDARY SCHOOL BOYS GRADES 7 TO 12 INCLUSIVE

FOR PURPOSES OF COMPETITION IN INTERSCHOOL ATHLETICS AND IN INDIVIDUAL EVENTS—DERIVED FROM THE FORMULA $2A$ (years) $+$ $.475H$ (inches) $+$ $.16W$ (lbs.)

(Adopted by the California Interscholastic Federation, May, 1935.)

Exponent	Age	Height	Weight	Exponent	Age	Height	Weight
9			53–59	24	11:9–12:2	49½–51½	147–153
10			60–65	25	12:3–12:8	52 –53½	154–159
11			66–71	26	12:9–13:2	54 –55½	160–165
12			72–78	27	13:3–13:8	56 –57½	166–171
13			79–84	28	13:9–14:2	58 –59½	172–178
14			85–90	29	14:3–14:8	60 –62	179–184
15			91–96	30	14:9–15:2	62½–64	185–190
16			97–103	31	15:3–15:8	64½–66	191 up
17			104–109	32	15:9–16:2	66½–68	
18			110–115	33	16:3–16:8	68½–70½	
19			116–121	34	16:9–17:2	71 –72½	
20			122–128	35	17:3–17:8	73 –74½	
21			129–134	36	17:9–18:2	75 up	
22	10:9–11:2	47 down	135–140	37	18:3–18:8		
23	11:3–11:8	47½–49	141–146	38	18:9–19:2		

NOTE: Height is measured in half-inches. The boy must have attained the height listed before the exponent value changes. For example, he remains at 49 until he reaches 49½.

Class	Exponent Value (Sum of exponents)
A	88 and above
B	83–87
C	79–82
D	75–78
E	70–74
F	69 and below

EVENT No. 25
Run—100 Yards

Classes

Time in seconds and tenths

Score	*F*	*E*	*D*	*C*	*B*	*A*	*Score*
100			11.0		10.4		100
99	12.1	11.5		10.6		10.3	99
98			11.1		10.5		98
97	12.2	11.6		10.7		10.4	97
96			11.2		10.6		96
95	12.3	11.7		10.8		10.5	95
94			11.3		10.7		94
93	12.4	11.8		10.9		10.6	93
92							92
91			11.4		10.8		91
90	12.5	11.9		11.0		10.7	90
89			11.5		10.9		89
88	12.6	12.0		11.1		10.8	88
87			11.6		11.0		87
86	12.7	12.1		11.2		10.9	86
85			11.7		11.1		85
84	12.8	12.2		11.3		11.0	84
83							83
82	12.9	12.3	11.8	11.4	11.2	11.1	82
81							81
80			11.9		11.3		80
79	13.0	12.4		11.5		11.2	79
78			12.0		11.4		78
77	13.1	12.5		11.6		11.3	77
76			12.1		11.5		76
75	13.2	12.6		11.7		11.4	75
74			12.2		11.6		74
73	13.3	12.7		11.8		11.5	73
72							72
71			12.3		11.7		71
70	13.4	12.8		11.9		11.6	70
69			12.4		11.8		69
68	13.5	12.9		12.0		11.7	68
67			12.5		11.9		67
66	13.6	13.0		12.1		11.8	66
65			12.6		12.0		65
64	13.7	13.1		12.2		11.9	64
63							63
62	13.8	13.2	12.7	12.3	12.1	12.0	62
61							61
60			12.8		12.2		60
59	13.9	13.3		12.4		12.1	59
58			12.9		12.3		58
57	14.0	13.4		12.5		12.2	57
56			13.0		12.4		56
55	14.1	13.5		12.6		12.3	55
54			13.1		12.5		54
53	14.2	13.6		12.7		12.4	53
52							52
51			13.2		12.6		51

EVENT No. 25 (Continued)
Run—100 Yards

Classes

Time in seconds and tenths

Score	*F*	*E*	*D*	*C*	*B*	*A*	*Score*
50	14.3	13.7		12.9		12.5	50
49			13.3		12.7		49
48	14.4	13.8		13.0		12.6	48
47			13.4		12.8		47
46	14.5	13.9		13.1		12.7	46
45			13.5		12.9		45
44	14.6	14.0		13.2		12.8	44
43							43
42	14.7	14.1	13.6	13.3	13.0	12.9	42
41							41
40			13.7		13.1		40
39	14.8	14.2		13.4		13.0	39
38			13.8		13.2		38
37	14.9	14.3		13.5		13.1	37
36			13.9		13.3		36
35	15.0	14.4		13.6		13.2	35
34			14.0		13.4		34
33	15.1	14.5		13.7		13.3	33
32							32
31			14.1		13.5		31
30	15.2	14.6		13.8		13.4	30
29			14.2		13.6		29
28	15.3	14.7		13.9		13.5	28
27			14.3		13.7		27
26	15.4	14.8		14.0		13.6	26
25			14.4		13.8		25
24	15.5	14.9		14.1		13.7	24
23							23
22	15.6	15.0	14.5	14.2	13.9	13.8	22
21							21
20			14.6		14.0		20
19	15.7	15.1		14.3		13.9	19
18			14.7		14.1		18
17	15.8	15.2		14.4		14.0	17
16			14.8		14.2		16
15	15.9	15.3		14.5		14.1	15
14			14.9		14.3		14
13	16.0	15.4		14.6		14.2	13
12							12
11			15.0		14.4		11
10	16.1	15.5		14.7		14.3	10
9			15.1		14.5		9
8	16.2	15.6		14.8		14.4	8
7			15.2		14.6		7
6	16.3	15.7		14.9		14.5	6
5			15.3		14.7		5
4	16.4	15.8		15.0		14.6	4
3							3
2	16.5	15.9	15.4		14.8	14.7	2
1				15.1			1

EVENT NO. 29
Running Broad Jump

Classes

Distance in feet and inches

Score	*F*	*E*	*D*	*C*	*B*	*A*	*Score*
100	16–3	17–1	18–0	19–3	20–9	22–2	100
99	16–2	17–0	17–11	19–2	20–7	22–0	99
98	16–1	16–10	17–9	19–0	20–6	21–11	98
97	15–11	16–9	17–8	18–11	20–4	21–9	97
96	15–10	16–8	17–7	18–9	20–3	21–7	96
95	15–9	16–7	17–5	18–8	20–1	21–6	95
94	15–8	16–5	17–4	18–6	20–0	21–4	94
93	15–7	16–4	17–2	18–5	19–10	21–2	93
92	15–5	16–3	17–1	18–3	19–8	21–0	92
91	15–4	16–1	17–0	18–2	19–7	20–11	91
90	15–3	16–0	16–10	18–0	19–5	20–9	90
89	15–2	15–11	16–9	17–11	19–4	20–7	89
88	15–1	15–10	16–8	17–9	19–2	20–6	88
87	14–11	15–8	16–6	17–8	19–0	20–4	87
86	14–10	15–7	16–5	17–6	18–11	20–2	86
85	14–9	15–6	16–4	17–5	18–9	20–1	85
84	14–8	15–5	16–2	17–3	18–8	19–11	84
83	14–7	15–3	16–1	17–2	18–6	19–9	83
82	14–5	15–2	16–0	17–0	18–5	19–7	82
81	14–4	15–1	15–10	16–11	18–3	19–6	81
80	14–3	14–11	15–9	16–9	18–1	19–4	80
79	14–2	14–10	15–7	16–8	18–0	19–2	79
78	14–1	14–9	15–6	16–6	17–10	19–1	78
77	13–11	14–8	15–5	16–5	17–9	18–11	77
76	13–10	14–6	15–3	16–3	17–7	18–9	76
75	13–9	14–5	15–2	16–2	17–6	18–8	75
74	13–8	14–4	15–1	16–1	17–4	18–6	74
73	13–7	14–2	14–11	15–11	17–2	18–4	73
72	13–5	14–1	14–10	15–10	17–1	18–2	72
71	13–4	14–0	14–9	15–8	16–11	18–1	71
70	13–3	13–11	14–7	15–7	16–10	17–11	70
69	13–2	13–9	14–6	15–5	16–8	17–9	69
68	13–1	13–8	14–4	15–4	16–6	17–8	68
67	12–11	13–7	14–3	15–2	16–5	17–6	67
66	12–10	13–5	14–2	15–1	16–3	17–4	66
65	12–9	13–4	14–0	14–11	16–2	17–3	65
64	12–8	13–3	13–11	14–10	16–0	17–1	64
63	12–7	13–2	13–10	14–8	15–11	16–11	63
62	12–5	13–0	13–8	14–7	15–9	16–9	62
61	12–4	12–11	13–7	14–5	15–7	16–8	61
60	12–3	12–10	13–6	14–4	15–6	16–6	60
59	12–2	12–9	13–4	14–2	15–4	16–4	59
58	12–1	12–7	13–3	14–1	15–3	16–3	58
57	11–11	12–6	13–2	13–11	15–1	16–1	57
56	11–10	12–5	13–0	13–10	14–11	15–11	56
55	11–9	12–3	12–11	13–8	14–10	15–10	55
54	11–8	12–2	12–9	13–7	14–8	15–8	54
53	11–7	12–1	12–8	13–5	14–7	15–6	53
52	11–5	12–0	12–7	13–4	14–5	15–4	52
51	11–4	11–10	12–5	13–2	14–4	15–3	51

EVENT NO. 29 (Continued)
Running Broad Jump
Classes
Distance in feet and inches

Score	*F*	*E*	*D*	*C*	*B*	*A*	*Score*
50	11–3	11–9	12–4	13–1	14–2	15–1	50
49	11–2	11–8	12–3	13–0	14–0	14–11	49
48	11–1	11–6	12–1	12–10	13–11	14–10	48
47	10–11	11–5	12–0	12–9	13–9	14–8	47
46	10–10	11–4	11–11	12–7	13–8	14–6	46
45	10–9	11–3	11–9	12–6	13–6	14–5	45
44	10–8	11–1	11–8	12–4	13–5	14–3	44
43	10–7	11–0	11–6	12–3	13–3	14–1	43
42	10–5	10–11	11–5	12–1	13–1	13–11	42
41	10–4	10–9	11–4	12–0	13–0	13–10	41
40	10–3	10–8	11–2	11–10	12–10	13–8	40
39	10–2	10–7	11–1	11–9	12–9	13–6	39
38	10–1	10–6	11–0	11–7	12–7	13–5	38
37	9–11	10–4	10–10	11–6	12–5	13–3	37
36	9–10	10–3	10–9	11–4	12–4	13–1	36
35	9–9	10–2	10–8	11–3	12–2	13–0	35
34	9–8	10–1	10–6	11–1	12–1	12–10	34
33	9–7	9–11	10–5	11–0	11–11	12–8	33
32	9–5	9–10	10–4	10–10	11–10	12–6	32
31	9–4	9–9	10–2	10–9	11–8	12–5	31
30	9–3	9–7	10–1	10–7	11–6	12–3	30
29	9–2	9–6	9–11	10–6	11–5	12–1	29
28	9–1	9–5	9–10	10–4	11–3	12–0	28
27	8–11	9–4	9–9	10–3	11–2	11–10	27
26	8–10	9–2	9–7	10–1	11–0	11–8	26
25	8–9	9–1	9–6	10–0	10–11	11–7	25
24	8–8	9–0	9–5	9–11	10–9	11–5	24
23	8–7	8–10	9–3	9–9	10–7	11–3	23
22	8–5	8–9	9–2	9–8	10–6	11–1	22
21	8–4	8–8	9–1	9–6	10–4	11–0	21
20	8–3	8–7	8–11	9–5	10–3	10–10	20
19	8–2	8–5	8–10	9–3	10–1	10–8	19
18	8–1	8–4	8–8	9–2	9–11	10–7	18
17	7–11	8–3	8–7	9–0	9–10	10–5	17
16	7–10	8–1	8–6	8–11	9–8	10–3	16
15	7–9	8–0	8–4	8–9	9–7	10–2	15
14	7–8	7–11	8–3	8–8	9–5	10–0	14
13	7–7	7–10	8–2	8–6	9–4	9–10	13
12	7–5	7–8	8–0	8–5	9–2	9–8	12
11	7–4	7–7	7–11	8–3	9–0	9–7	11
10	7–3	7–6	7–10	8–2	8–11	9–5	10
9	7–2	7–5	7–8	8–0	8–9	9–3	9
8	7–1	7–3	7–7	7–11	8–8	9–2	8
7	6–11	7–2	7–6	7–9	8–6	9–0	7
6	6–10	7–1	7–4	7–8	8–4	8–10	6
5	6–9	6–11	7–3	7–6	8–3	8–9	5
4	6–8	6–10	7–1	7–5	8–1	8–7	4
3	6–7	6–9	7–0	7–3	8–0	8–5	3
2	6–5	6–8	6–11	7–2	7–10	8–3	2
1	6–4	6–6	6–9	7–0	7–9	8–2	1

Supervising Student Teachers in Physical Education at the University of Michigan (Secondary School Level)*

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INTRODUCTION

ALTHOUGH the importance of directed teaching as a necessary part of the education of a teacher seems axiomatic, the forthcoming National Survey of the Education of Teachers will show a widespread failure on the part of institutions to set up sound programs. In some instances institutions make only superficial provisions for directed teaching, usually under the compulsion of certificate requirements. In other instances institutions have good facilities but employ indefensible practices. There is a failure to make adequate and sensible arrangements for directed teaching. This explains why in the most recent platform on directed teaching the first principle is stated, "Directed teaching is a necessary part of the education of a teacher."[1] Baker[2] observed the great need for better and more scientific studies of the entire problem of student teaching and contributed much to our present understanding of the situation. Since the advent of professional courses for teachers of physical education some efforts for actual teaching experience of students have been made. The quality and type of this experience has not always been of the best, although there has been continuous improvement. Much of this improvement may be attributed to the influence of education and the increasing tendency to interpret physical education as a method of education.

Interest in improved education of teachers of physical education is reflected in recent studies and surveys.

Considerable attention has been paid to the definition of the total problem of teacher training. The most extensive study is that being conducted by the Committee on Teacher Training of the A.P.EA.[3]

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* A paper presented before the Teacher-Training Section of the Mid-West District Physical Education Association Convention, April, 1935, at Milwaukee, Wisconsin.

[1] Raleigh Schorling, "Directed Teaching." Reprinted from the *Education of Teachers, 1935 Yearbook of the National Society of College Teachers of Education*, p. 132–133.

[2] Gertrude Baker, "The Supervision of Practice Teaching in Physical Education in Undergraduate Institutions in the United States," Research Quarterly, I:4 (Dec., 1930), 122–132.

[3] See "Report of the Committee on Teacher Training in Physical Education in the United States," N. P. Neilson, Chairman, Research Quarterly, IV:1 (Mar., 1933),

One of the major problems in any study of the professional training of teachers is the kind and amount of directed teaching. Brownell[4] has commented on the differences of opinion which arise regarding the relation of *practice* in teaching to theory of teaching. Blanchard,[5] in a study of teacher preparation of Detroit teachers says in part: "the teacher-training institutions should provide more practice teaching and practical application of courses with less theory, recognizing that prospective teachers learn by doing as well as do children." His study also revealed a low correlation between training received in college and problems experienced in actual teaching situations.

Additional suggestions for improving the professional education of teachers in general and student teaching in particular may be obtained from an investigation of studies and recommendations of such groups as the National Society of College Teachers of Education,[6] Supervisors of Student Teaching of the American Association of Teachers Colleges,[7] and Supervisors and Directors of Instruction of the National Education Association.[8] Most of these suggestions are pertinent for physical education.

In describing the type of teaching experienced by the student in his teacher preparation, three different phrases have been used: (1) student teaching; (2) practice teaching; and (3) directed teaching. These phrases have been used interchangeably and synonymously. For the sake of greater clarity, however, the actual teaching experiences of students in training will be referred to from now on as *directed teaching*. From the viewpoint of supervision this phrase is superior to "practice teaching" since it implies less of the trial-and-error and more of the intelligent guidance procedures. It embodies all types of teaching by students in which there is responsibility for conducting actual class activities of a pupil learning type. It implies *direction* and *guidance* on the part of critic teachers and supervisors so that a minimum desirable quality of instruction may be insured at all times.

PROBLEM OF DIRECTED TEACHING AT UNIVERSITY OF MICHIGAN

At the University of Michigan, directed teaching has been recognized as an essential part of the training for physical education students

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51–67. This study was initiated by the Department of School Health and Physical Education of the N.E.A. Cooperating groups include the A.P.E.A., Administrative Directors' Society, National Association of Directors of Physical Education for College Women, Society of State Directors, and College Physical Education Association.

[4] C. L. Brownell, "The Present Status of Professional Preparation of Teachers in Physical Education," RESEARCH QUARTERLY, III:2 (May, 1932), 115.

[5] V. S. Blanchard, "Guiding Principles in Teacher Training from a Public School Point of View," RESEARCH QUARTERLY, III:2 (May, 1932), 92.

[6] See *Yearbooks*.

[7] See *Yearbooks*.

[8] See *Yearbooks*.

since the inception of the professional curriculum (1921). The University High School, a laboratory-demonstration school, has been utilized since 1924 as an experience center for physical education as well as other professional students of education interested in obtaining the teachers' certificate. In the beginning the responsibility for supervision of student teachers was vested in the position of advisor to professional students of physical education, who was designated also as Director of Physical Education for Girls at University High School. The appointment in the University Department of Physical Education carried the title of assistant professor. A teacher of physical education at the high school assisted. While this organization may have been sound in theory, it did not prove to be the most desirable arrangement in practice—due primarily to the increasing responsibilities associated with the position of advisor to professional students. Changes are indicated in the description of the present organization and activities of supervising student teachers, which follows.

All statements made pertain to women students only and are confined to the secondary school level.

ORGANIZATION AND PERSONNEL

All directed teaching in the University High School is under the supervision of the School of Education and delegated to the immediate position of "Supervisor of Directed Teaching and Instruction of University High School." Heads of the various high school departments act as assistants in the capacity of *cooperative* or *critic teachers*.[9] For physical education, additional assistance comes from the University Department of Physical Education for Women.[10] This assistance is designated as supervisory; the rank of the position is assistant professor of physical education with one of the chief responsibilities that of supervising student teachers. The program of supervision is worked out cooperatively with the cooperating or critic teacher of physical education at University High School. The organization may be diagrammed as follows:

OBJECTIVES OF DIRECTED TEACHING

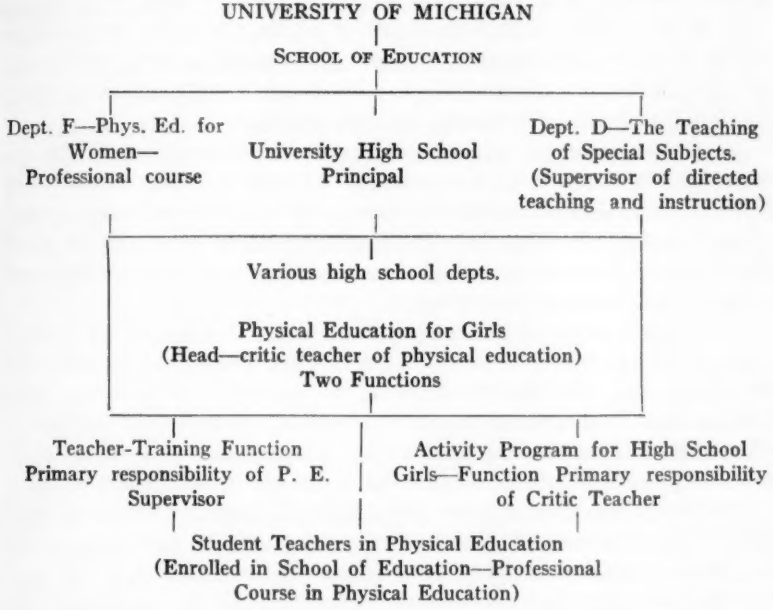
The general aim of directed teaching is to provide student teachers with experience in the routines, organization, selection of content, planning, and actual teaching of physical education. These experiences are embodied more specifically in the following goals:

1. Goals associated with class organization and control. These include such activities as (*a*) the ability to discharge routines associated

[9] See Raleigh Schorling, "Three Issues Suggested by the Program of Teacher Training at the University of Michigan," *Supervisors of Student Teaching, Fourteenth Annual Session, Cleveland, Ohio, Feb. 26–27, 1934*, p. 93–101 for a more complete description.

[10] Salary for this position comes chiefly from the School of Education budget.

ORGANIZATION OF DIRECTED TEACHING, PHYSICAL EDUCATION FOR WOMEN—UNIVERSITY OF MICHIGAN 1934–35


UNIVERSITY OF MICHIGAN
School of Education
Dept. F—Phys. Ed. for Women—Professional course
University High School Principal
Dept. D—The Teaching of Special Subjects. (Supervisor of directed teaching and instruction)
Various high school depts.
Physical Education for Girls
(Head—critic teacher of physical education)
Two Functions
Teacher-Training Function
Primary responsibility of P. E. Supervisor
Activity Program for High School Girls—Function Primary responsibility of Critic Teacher
Student Teachers in Physical Education
(Enrolled in School of Education—Professional Course in Physical Education)

with roll call with dispatch and efficiency; (*b*) the ability to organize the class for activities promptly and without waste of time; (*c*) the ability to have all necessary equipment ready beforehand; and (*d*) the ability to create an atmosphere of friendly cooperation and business-like enterprise at the very beginning of the period through the correct use of voice; maintenance of poise and good posture; waiting for quiet; sizing up the situation; being properly attired, etc.

2. Goals associated with the actual teaching process. These include (*a*) knowing how to use correctly teaching procedures like demonstration, discussion, drill, problem solving, coaching, refereeing, testing, and teacher participation; (*b*) knowing when to use these procedures, ability to adapt the procedure to the needs of the group and to the type of subject matter selected; (*c*) knowing how to utilize student leadership to the best advantage; and (*d*) appreciating what is meant by "good teaching."

3. Goals associated with planning. These include (*a*) demonstrated ability to plan in general for a six- to eight-week period and specifically for a single day or week; (*b*) knowledge of the principles of good planning with some appreciation for this value.

4. Goals associated with subject matter. These include (*a*) knowledges concerning selection of suitable subject matter for junior and senior

high school students; (*b*) an appreciation of objectives; (*c*) ability to adapt subject matter to the situation; and (*d*) an appreciation of the relation of intramural and health activities to the activity program.

5. Goals associated with the needs of pupils. These include a knowledge and understanding of the health and physical status of pupils and an appreciation of their needs. It also includes familiarity with social, economic, and academic background of students.

6. Goals associated with the improvement of teaching. These include (*a*) the ability to take an objective attitude towards teaching; (*b*) an attempt to understand and overcome personality weaknesses which might handicap teaching success; (*c*) demonstrated ability to get along with other student teachers and high school pupils; (*d*) an expressed willingness to learn and improve.

7. Goals associated with equipment and facilities which include discharging responsibilities related to the hygiene of the teaching environment, e.g., ventilation, lighting, arrangement of facilities, etc.; and the organization of the group to prevent loss or misuse of equipment.

8. In addition, student teachers are expected to fulfill certain goals regarding the discharge of clerical duties associated with their teaching.

Each of these general goals might be elaborated and discussed more fully. This is done with the student teacher at the beginning of her experience in teaching. Supervisory efforts are made to provide the type of experiences implied by these goals and to help the student teacher reach a satisfactory realization.

SELECTION OF STUDENT TEACHERS FOR DIRECTED TEACHING

Experience of student teachers prior to their admission to directed teaching (which is scheduled for the senior year) includes satisfactory completion of the basic science; general cultural; education; and professional activity and theory courses of the first three years of the course in physical education. Courses pertaining to teaching include: theory and practice of tennis, hockey, swimming, rhythms, archery, elementary and intermediate games, stunts, posture, gymnastics, baseball, track, clog and tap, folk dancing, basketball, golf, fieldball, and soccer; officiating of team sports; methods of teaching (practice teaching) elementary school and secondary school program; community recreation; introduction to tests and measurements; individual gymnastics; educational psychology; and education in the United States (this course is a combination of principles of teaching and history of education).

In addition, students are expected to pass satisfactorily a qualifying examination—both practical and theoretical—in physical education subject matter. They should have one and one-fourth as many honor points as credits but this is not required for admission to directed teaching. (Equivalent to an average academic grade between *B* and *C*.)

SCHEDULING—CREDIT—AMOUNT OF TEACHING

In so far as possible directed teaching is scheduled first in the students' program and other subjects worked around it. During the past year the practice of calling a meeting of the prospective teachers towards the end of the junior year and making tentative assignments has been employed. This seems to be a desirable practice and will be continued. At the time of this meeting, the opportunities for directed teaching are discussed with the group; the particular problems likely to be encountered in the various situations are pointed out; and the qualifications necessary for successful student teaching are indicated. Students are asked their preference for teaching after this discussion. Usually, they confer with the instructor in charge of student teachers as to the situation in which they are likely to be the most successful, and a tentative assignment is made.

Student teachers in physical education at Michigan spend one semester teaching in the University High School and one semester in the elementary grades of the Ann Arbor public schools. The University High School classes meet four days a week—class periods are fifty-five minutes. In addition, one hour per week is scheduled for a group conference with the general supervisor of directed teaching and instruction (Course D-100); one hour for a group conference with the physical education critic teacher and supervisor; and additional time, as needed, for formal or informal individual conferences. Four semester hours of credit are allowed for the teaching in the University High School.[11]

All student teachers register for course "D-100 Directed Observation and Teaching," a four-hour course.

POLICIES OF DIRECTED TEACHING AND SUPERVISION

Policies and procedures are based on the belief that supervision exists for the primary purpose of improving teaching. The student teacher learns to teach by teaching. When she is so engaged the critic teacher and supervisor act as cooperating teachers, who participate in the regular class activities and give assistance as needed (provided, of course, this assistance can be given in a natural manner without interrupting the regular plan of the student teacher). Success in teaching is necessary for growth. This is as true of the experienced teacher as of the beginner. One of the jobs of those responsible for directed teaching in teachers' colleges, therefore, is to provide experiences in which the student

[11] In addition three semester hours of credit are granted for teaching in the elementary grades. This is in accordance with practice in other subject-matter fields and is in accordance with recommendations for improving professional training in physical education. See N. P. Neilson, "A Curriculum for the Professional Preparation of Physical Education Teachers for Secondary Schools," RESEARCH QUARTERLY, II:1 (March, 1931), 217–226, recommending (p. 225) six hours of credit; also N. P. Neilson, "Report of the Committee on Teacher Training in Physical Education in the United States," IV:1 (March, 1933), 62, recommending six hours of credit.

teacher will be successful. Too much discouragement at the beginning is a bad thing. At Michigan, we try to put this philosophy into practice by employing certain procedures. These include:

1. Acquainting the student teacher with the general situation in which she will teach during her junior year. This is done by having two or three meetings of the secondary school program (*practice teaching*) course meet at the high school under the direction of the critic teacher. High school students are usually present at these meetings—which are in the form of demonstration lessons—and the prospective student teachers participate with them.[12]

2. Familiarizing junior students with the content of the high school program. The content for secondary school program (practice teaching) is based on the specific job of learning to teach in the University High School.

3. Providing student teachers during their junior year with an opportunity to assist and teach six to nine times in junior or senior high school classes.[13]

4. Familiarizing them, at the end of their junior year, with the teaching possibilities for the fall; discussing the nature of each teaching situation; and tentatively assigning students in terms of their ability to do a successful job.

5. Gradual initiation into the responsibilities of teaching by having student teachers participate as members of the group and at the same time learn the routines of class management.

6. Group and individual discussions the first few weeks; use of the workbook; careful planning of the first teaching period; planning a calendar.

All of these procedures aid the critic teacher and supervisor in learning to know something of the ability of the student teachers early in the season. There are many opportunities for establishing the congenial and friendly relationships which are so essential to the success of any directed teaching program.

SPECIFIC SUPERVISORY DEVICES USED

A number of specific supervisory devices have been developed and used more or less consistently during the past five years. These seem to have value as aids in helping student teachers do increasingly better jobs and include:

1. The use of a workbook for beginning teachers.

2. The development of a tentative course of study for University High School.

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[12] These lessons have included intermediate games; captainball; captain basketball; and nine-court basketball.

[13] This is done as a required part of the course "Secondary School Program" (practice teaching).

3. Directed observation.
4. Planning. Seasonal; weekly; detail planning of first lesson.
5. Self-evaluations and daily diary reports.
6. Weekly group conferences.
7. Individual conferences—(*a*) informal following teaching; (*b*) more formal.
8. Written criticisms by critic teacher and supervisor.
9. Confidential written evaluations of progress at end of six-to eight-week period of teaching.
10. The use of rating scales.

It is impossible in the course of the time allowed to discuss each one of these devices thoroughly. A brief comment at this time will suffice to indicate the specific use being made of these various devices for ***improving student teaching.***

1. The workbook has been prepared to facilitate directing student teaching, especially during the introductory phases. The purpose is stated in the foreword as follows:

> "This workbook has been prepared to help beginning teachers in physical education become oriented to their teaching responsibilities and to suggest to them specific type situations in which principles of good teaching may be applied. Materials are arranged by units in the order in which the various experiences usually occur. Obviously there can be no fixed order for the study of these units, since, to the beginning teacher especially, a great many new experiences occur at the same time. It is suggested, therefore, that the order of units be considered flexible and adaptable to the particular needs of the teacher."

Topics of some of the units are:

a) Getting acquainted with your high school.
b) Getting acquainted with your pupils.
c) Learning class routines.
d) Clerical duties.
e) Teaching materials and subject matter (including an inventory of equipment).
f) Planning—including suggestions for seasonal as well as weekly planning.
g) Your first teaching period.
h) Program for rainy days and cold weather.
i) Some teaching procedures.

2. A tentative course of study[14] indicating amount of subject matter to be covered in each grade and in each activity is available. Subject matter is set up in terms of objectives to be accomplished. Objectives include skills, knowledges, and behaviors associated with physical education activities. The content was developed from a study of the high school program over a period of years, supplemented by actual experimentation to develop certain standards. This course acts as a *guide* to

[14] Jeannette Saurborn, A Tentative Course of Study in Physical Education for Girls at University High School, Ann Arbor, Michigan. M. A. Thesis, August, 1933 (unpublished).

student teachers in their selection of subject matter and tends to insure greater progression in learning. As in all courses of study, many of the standards are due for a revision—possibly the revision will be in terms of guide sheets for high school students and student teachers.

3. Directed observation is made use of more during the junior year than during the senior year. Most of the observation is in terms of demonstration lessons for a particular need—e.g., to illustrate good organization; to show how to go from one activity to another in a games period without wasting time; to illustrate the use of discussion; how to coach; and so on. Student teachers are given suggestions for observation in terms of the specific problem. Some observation in the classroom is carried on in connection with assignments made by the general supervisor of directed teaching (Course D-100 Directed Observation and Teaching).

4. Planning is first by the season; then for the first day of teaching; and then by the week. Each student teacher determines the content to be covered during the season and makes a calendar showing the amount of time available. This calendar is corrected and approved by the critic teacher before the student teacher plans her first full teaching period. This period is planned in considerable detail and usually runs from two to three typewritten pages in length. The student teacher is asked to write out all of the things she expects to do. The following suggestions act as aids:

a) Plan to begin the period promptly by thinking through routines of roll call, equipment, readiness of gymnasium, etc.

b) Note the attention of the class. How to obtain the attention from the very start.

c) Note the discipline of the class. Know what causes discipline problems and plan not to have the causes develop.

d) Be sure of your control of subject matter. List the essentials of correct technique, rules, and so on.

e) Think through your organization carefully—diagram.

f) Think through your teaching procedures carefully. Do not plan long discussions the first day. Plan to do as little talking yourself as possible.

g) Be critical of your plan—evaluate it after you teach.

Each of these general suggestions is elaborated in some detail for the student teacher. She is expected to put these suggestions into lesson plan form. The form used is:

Statement of specific objectives primarily in terms of pupil objectives and activities (what you aim or propose to do).

List of activities (which will be used to accomplish this purpose).

Organization (for efficiency and economy).

Presentation (how you will attempt to achieve your aim or purpose).

Self-evaluation—to be written after teaching (how could you improve this lesson).

All lesson plans follow this form but are reduced in the amount of detail expected as the student learns how to plan effectively. The chief

purpose of the detail planning is to make the student think through her entire period ahead of time.

5. The self-evaluation is considered one of the most important devices used. These are written by the student at the end of each lesson taught and are referred to as her "diary reports." No specific form is required. The student is encouraged to state informally and frankly what happened, what she learned, and how things could be improved. The main purpose of this device is to help students develop the habit of looking at their own teaching objectively. After all, most improvement in teaching comes with the ability to analyze one's own teaching objectively and to make self-improvements.

6. The weekly group conference is used to discuss problems of common interest to the group. It has been found to be a great time saver for students as well as supervisors.

7. Individual conferences are held at regular intervals at the request of the supervisor (usually three to four times per semester) and whenever the student requests. The conferences called by the supervisor are of a more formal type in that specific plans are made for discussing particular problems of the student teacher. Conferences at the student teacher's request are usually more informal and consist primarily of "talking over" whatever is on her mind. In so far as possible brief suggestions are given verbally at the end of each teaching period. Students are invited to ask for suggestions.

8. Brief written criticisms by critic teacher and supervisor follow a number of teaching periods. These criticisms aim to be constructive and are made out immediately following the teaching period. They are always made out in duplicate and frequently are used as the basis of conferences.

9. The confidential written evaluation arose in response to student request. At the end of the first six- to eight-week period, each student teacher is given a confidential written evaluation of the kind of teacher she impresses us as being. The purpose of this evaluation is to establish more understanding relationships between student teacher and supervisors and to give the student teacher a statement of what we think of her—not that we believe our opinion to be infallible—but because we believe the student teacher is entitled to know what her supervisors honestly think of her. The evaluation includes comments, supported by concrete illustrations of observed behavior, concerning:

a) Professional attitude. This pertains to the directness and sincerity with which the student goes about her teaching responsibilities. This also includes professional interest and enthusiasm observed.

b) Professional responsibility. This includes quality of preparation and planning; promptness in completing assignments; keeping appointments; and attending to teaching duties.

c) Teaching ability as demonstrated. This includes general approach, contacts with students, methods used and their effectiveness.

d) Teaching personality which includes voice, dress, poise, social behavior, and analysis of own teaching difficulties.

These evaluations are confidential. They are not used for any other purpose than to give the student teacher an insight into how "others see her." If she wishes a discussion of the evaluation her request is always granted.

10. Rating scales are used by the School of Education at the end of the semester to appraise the student's success. At present three different forms are in use.[15]

EVALUATING SUPERVISION

The program of directed teaching in physical education for women at the University of Michigan has been a continually evolving one. That there has been progress is evident to those who have been closely associated with the problem. Yet to define that progress in objective and measurable terms is difficult. Evaluation implies appraisal—"or the judgment of the worth of the item as a whole, with reference to some adopted purpose."[16] Suggestions[17] from the check list for self-analysis for supervisors as proposed by the Department of Supervisors and Directors of Instruction of the N.E.A. have been instrumental in guiding our thinking.

Some specific activities which have been associated with evaluation are:

1. Suggestions from student teachers for the improvement of supervision.
2. Suggestions from high school students for the improvement of student teachers.
3. Self-ratings of student teachers.
4. Success of the student teachers.
5. Reviewing our program in terms of the specific goals set up.
6. Maintaining an objective and "scientific" attitude towards our supervisory activities; the conscious attempt to put theory into practice; and to adapt general supervisory techniques to physical education.[18]

Of these various activities, the suggestions from high school students regarding the qualities of personality in student teachers which they admire proved to be most stimulating to both supervisors and

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[15] For information write Raleigh Schorling, School of Education, University of Michigan, Ann Arbor, Michigan.

[16] "Evaluation of Supervision," *4th Yearbook, Dept. of Supervisors and Directors of Instruction, N.E.A.*, p. 12.

[17] *Ibid.*, p. 103–105.

[18] Considerable assistance for this has been obtained from George Kyte, *How to Supervise.*

student teachers.[19] The ten most important qualities are:

a) Fairness and impartiality.
b) Even tempered, not grouchy.
c) Ability to "act like one of us and not our superior."
d) Ability to play well and be a good athlete.
e) Friendliness.
f) Neatness.
g) Helpfulness.
h) Patience.
i) Willingness to play with group.
j) Firmness but not strictness.

Plans are in progress to obtain more satisfactory evidences of the value of supervision during the five-year period 1930–35. In the meantime, evaluation is accepted as a state of mind which is constantly questioning the value of procedures used for the purpose of improving the situation.

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[19] Questionnaire study made by Jeannette Saurborn (unpublished).

A Brief History of the Development of Swimming

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EGYPT AND ASSYRIA

THE HISTORY of swimming and its precursor, bathing, may be traced in fact and fiction in the literature and art of ancient civilizations. Accounts of the aquatic art take us back some 4,000 years to Egypt. There it is recorded that swimming instructors were known upon the banks of the Nile, for a nobleman of the middle kingdom (2160–1780 B.C.) left testimony to the fact that his children and the children of the king took their swimming lessons together.[1]* The nature of these instructions is unknown and to estimate how long swimming had been in vogue prior to these dates would be hypothetical.

A relief of Egyptian history shows the soldiers of Rameses II (1292–1225) swimming the Orontes River in an effort to escape the Hittites.[2] Other reliefs show that the Assyrians were acquainted with swimming; although it would appear that they were not as proficient in the water as the Egyptians, for whenever it was possible they made use of inflated skins to buoy them up, propelling themselves with one arm.[3]

The illustrations in relief suggest an over-arm movement in most cases. The legs appear to drag and do not picture any definite stroke or action. It therefore seems suppositional to infer that the Egyptians and Syrians were acquainted with the modern crawl.

GREECE

Greece, geographically and politically, was ideally situated to give full recognition to the importance of bathing and swimming. Baths were built in Cnossus and Phaistos and other Grecian cities as early as 1700–1400 B.C. Homer relates how certain of his heroes and heroines were accustomed to bathe.[4] From vase paintings owned by Sir W. Hamilton, and others in the Museum de Leyde and in the Louvre, we learn that shower baths are of ancient origin. Public baths did not, however, become of civic importance until a later date. Hot baths were in vogue in spite of the protests of Hesiod[5] and Homer[6] who considered warm water effeminate. It is also said that Socrates was like-minded and seldom bathed, considering it a luxury. It is interesting to note, in addition, that singing in the bath was considered the act of a boor.[7]

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* Numbers refer to bibliography at end of article.

Greek education consisted largely of letters, music, and physical education. So highly was physical education esteemed[8] by the populace that the state bore part of the cost of training. According to an old law ascribed to Solon, every boy had to know his letters and how to swim.[9] The proverb for an utter dunce was, "He knows neither his letters nor how to swim."[10] Plato adds that the girls were also proficient in the water and that all over the Maritime states swimming was a common accomplishment.[11] Showers, basins, and tanks were provided for athletes and a daily plunge in the Eurotas was a habit with Spartan boys in training.[12] Freeman says, "The importance attached to physical education was no doubt due to their intensive appreciation of bodily beauty, which it was the endeavor of their training to produce. But it must be remembered that to be in 'good condition' was essential to them. Any morning a Hellenic citizen might find himself called upon to take the field against an invader, or might be dispatched to ravage an enemy's country."[13]

Herodotus distinctly implies that all Hellenes knew how to swim. "The Hellenic loss at Salamis," he says, "was small. For as they knew how to swim (as opposed to the barbarians who did not), when their ships were destroyed they swam over to the island."[14] He takes it as a matter of course that every sailor could swim. The whole crew of a captured trireme, during the Peloponnesian War, as often as not, jumped overboard and escaped by swimming[15] using an overarm stroke.[16]

In a story in Athenaeus, the boys of Lasos, on coming out of the wrestling school, go off together for a bath and begin to dive.[17] A friend of Aristoppos used to boast to him of his diving.[18] During the blockade of Sphakteria by the Athenian fleet, numbers of Helots swam from the mainland to the island under water.[19]

There were also various gymnastic games, which young people played in the water together,[20] but of their nature nothing is known.

ROME

The Romans were early (300 B.C.) cognizant of the importance of swimming.[21] As far back as in the Republican Era, Roman youth was trained to bear arms and was made to include bathing and swimming in the Tiber among its training.[22] Swimming competitions formed part of the festivals and pageants.

Cassius was a renowned swimmer and Shakespeare puts the following passage to his credit:

> "I was born as free as Caesar; so were you.
> We both have fed as well, and we can both
> Endure the winter's cold as well as he.
> For once upon a raw and dusty day,
> The troubled Tiber chaffing with her shores,
> Caesar said to me, 'Dars't thou, Cassius, now

Leap in with me into this angry flood
And swim to yonder point?' Upon the word
Accoutred as I was, I plunged in
And bade him follow; so indeed he did.
The torrent roar'd and we did buffet it
With lusty sinews, throwing it aside
And stemming it with hearts of controversy;
But ere we could arrive the point proposed
Caesar cried, 'Help me, Cassius, or I sink'
I, as Aeneas, our great ancestor
Did from the flames of Troy upon his shoulder
The old Anchises bear, so from the waves of Tiber
Did I the tired Caesar."[23]

Of Caesar's ability to swim,[24] it is further quoted that, when his ship was attacked in battle at Alexandria, he leaped into the water and with books held high in one hand swam to another ship.

BATHS

The Roman baths, or *balneae*, were originally constructed for the lower classes.[25] But as they developed, the better orders became their patrons; and in time, emperors as well as the rabble enjoyed the same luxury. The public baths became gems of architectural beauty and technique. They were richly furnished of marble and bronze gilt. Gibbon says: "The walls of the lofty apartments were covered with curious mosaics that imitated the art of the pencil in the elegance of design and variety of colors. The Egyptian granite was beautifully incrusted with the precious green marble of Numidia; the perpetual stream of hot water was poured into the capacious basins through so many wide mouths of bright and massy silver; and the meanest Roman could purchase, with a small copper coin (a fraction of a farthing), the daily enjoyment of a scene of pomp and luxury which might excite the envy of the kings of Asia."[26]

The immense baths, supplied by stupendous aqueducts, could provide accommodation for many. The baths of Antonius Caracalla contained about 1,600 seats of marble, while more than 3,000 were reckoned in the baths of Diocletian.[27] Pompeii furnishes the two oldest Roman public baths extant. It was in the Imperial Thermae of Rome that the bath received its most complete architectural form.

The *apodyterium* was a spacious room for dressing. The bather left his clothes here with slaves known as *capsarii* and proceeded to the *unctuarium* where he was anointed with oil. For those desiring strenuous exercises, a court room (*atrium*), was provided. After this, one continued to the *caldarium* which was situated above the furnace or *hypocaust* and which would correspond to a Turkish bath. Here the accumulation of oil and perspiration was scraped from the body by a sort

of knife, a curved metal *strigil*. The poorer classes were obliged to scrape themselves but the rich took along their slaves for that purpose.[28] The *strigil* was a cruel instrument when roughly handled. Invalids preferred a sponge.

Thence to the *tepidarium* (warm room), generally the most highly ornamented chamber in the baths. Here one could sit and perspire beside a brazier containing burning charcoal.[29] Then to the *frigidarium* (cold bath). Where there was no pool, large basins or showers were provided and attendants poured on cold water.

Some baths had warm pools and some, cold and warm. The heating and architectural arrangements for some were amazingly intricate, but nevertheless startlingly efficient for the age. They suggest an extravagance of laborious effort at the expense of sweating, toiling slaves.

The baths developed as great social centers. Continuous shouting and laughter echoed from the building. They became the haunts of lecturers, poets, and philosophers. From sunrise to sunset patrons entered, left, and re-entered the baths, and eventually they remained open after nightfall. Children were admitted free and mingled with statesman and ragged plebeians. The latter, without shoes or mantle, loitered their time in the streets or forum and, Gibbon says: "Dissipated in extravagant gambling the miserable pittance of their wives and children and spent the hours of the night in obscure taverns and brothels in the indulgence of gross and vulgar sensuality."[30]

The Imperial Thermae at Rome had one set of public rooms. At times men and women were admitted to the baths at different hours and at times mixed and promiscuous bathing was permitted.[31] The excesses apparently common under the system of mixed bathing in the public baths were bound to produce a reaction, and in the Christian era the early church fathers generally agreed that bathing should be confined to cleanliness and health. Justinian recognized mixed bathing as grounds for divorce. The destruction of the Great Aqueduct, which provided the Roman baths with water, led to their closing. Various Roman rulers were responsible for the construction of this tremendous water system.[32] In the first century A.D. Agrippa added to the aqueducts and built 170 new baths.[33] Nero continued to increase the number during his reign.

The habit of the baths continued and in the twelfth century they were common, and in the fourteenth century and fifteenth century notorious. The Italian word *Bagnio*, meaning bath, was colloquially used for brothel. It is probable that prostitutes plied their business at the baths. The Roman baths, however, never became so public as to exhibit mixed nude bathing to the gaze of the street walkers.

Emperors found their way to popularity by throwing the baths open to the public for a day, free of charge. Some, to curry favor, provided free oil and barbers. The baths were closed at any public misfortune of

a serious nature and Caligula made it a capital offense to bathe on a religious holiday. It was also a capital offense to steal at the baths. The luxury concomitant with an empire of world-wide power led to extremes and the daily bath was repeated seven and eight and more times between daylight and dark. The partaking of meals during the bath became a fad, following the example of the dissolute Emperor Commodus.

While there were almost nine hundred[34] separate baths in Rome at the time of Constantine, the most famous ruins of such today are the Thermae of Titus, Caracalla, Diocletian, and the Thermae of Pompeii. In addition to the public baths, every private house of any size possessed its own bath and exercise room. It is not to be supposed that all these baths were large enough for swimming, although the larger public Thermae were so used.

The bath to the Roman was primarily a training process for soldiers. Later the bath was nothing but a matter for pleasure and even sensuality. The Jews were among the first to recognize the curative and medical values of certain waters where baths were instituted. Josephus tells us that when Herod was suffering from gout he was sent by his physicians to the warm baths at Callirrhoe beyond the Jordan which waters were also fit for drink.[35]

ENGLAND

Swimming was no doubt familiar to the inhabitants of England at all times. The heroes of the Middle Ages were sometimes praised for their skill in swimming. It is said of Olaf Trygesson, a King of Norway, that he had no equal in the art.[36] One of the requisites of a complete gentleman was swimming and was particularly recommended for those following the military profession.

It is recorded that boys in the country learned to swim with bundles of bullrushes and when these could not be readily procured corks were used.[37] In spite of the fact that swimming was a national pastime in England for ages, in one respect at least, it was considered an art of which the chief patron was the devil. The *Handbook for Readers and Writers* tells us that in the good old times witches were thrown into the water to sink or swim. If they sank, naturally they drowned; if they swam, it was clear proof that they were in league with the evil one; so it did not much matter one way or the other.

A poet of the middle ages wrote:

> "To swymme, is eke to lerne in sommer leson,
> Men fynde not a bridge, so often as a flood,
> Swymming to voyde; and chase an hoste will eson,
> Eke after rayne the rivers goeth wood (mad)
> That every man in t'host can swymme, is good;
> Knyght, squyer, footman, cook, and cosynere,
> And grome, and page, in swymming is to lire."[38]

Swimming and diving are mentioned by the author of the *Visions of Piers Ploughman* in the following manner, edited 1500, page 13:

"Take two strong men and in Temese (Thames) cast them,
And both naked as a needle, ther non sikerer (safer) than other;
The one hath cunnunge and can swymme and dyve,
The other is lewd of that laboure, lerned never to swymme,
Which trowest of these two in Temese is most in dred,
He that never dyved ne nought of swymming,
Or the swymmer that is safe is he himself lyke?"

The Roman conquests had been the means of introducing the baths into England and baths were located there in the time of Nero. The first public baths in Great Britain were opened by the corporation of Liverpool in 1828. The "Baths and Wash House Act" was passed in 1846.[39] In 1845 a public bath and wash house was built in Glasshouse Yard, London, for the poor.

From *Curiosities of London* it is found that two ancient baths remained in London in 1855: the Peerless Pool or the "Perilous Pond" on Old Street Road, and the "Bagnio," or Old Royal Baths, on Bath Street. An old Roman bath in the Strand, the oldest in London, and the "Cold Bath" in Coldbath Square, Clerkenwell, which had been known about 180 years, hardly allowed room for swimming evolutions. Many of the Roman baths had steps on all sides leading into the water, on which the bathers sat. In 1855 there were 30 or more, large or small, good or bad baths in London and its suburbs. All were well attended. In the best, water was changed daily, although one writer, Ralph Harrington, author of *A Few Words on Swimming*, said of the Holborn Casino, one of the leading baths in 1872, "The state of the water is so disgraceful and the dirt so nauseating that I seldom venture to enter it." One of the most commodious and interesting bathhouses was one built in 1754, by public subscription, at the mouth of the Portsmouth Harbor. The tide supplied four baths at different depths, two of which were large enough for swimming. Dressing-rooms for Ladies and "Gents" and hot baths were provided in the bathing house.

A description of swimming exists in England's oldest written language. It describes a swimming match between Beowulf and Breca. The contestants swam for five days in a raging flood. In the course of the race, they encountered sea serpents and other animals of a hideous nature which they slew.[40] Unfortunately three stop-watches were not on hand, so the record of Beowulf and Breca remains unofficial.

It is recorded that about 1830,[41] a Dr. Beddhoe or Bedale swam from Liverpool to Runcorn, full twenty miles, defeating Mr. Matthew Vipond by half a mile. He was, incidentally, assisted by a four-hour current. Nevertheless, it was a remarkable feat at that time. Two men

accompanied the doctor in a rowboat, one of whom occasionally furnished him with a bottle of brandy.

Lord Byron, who crossed the Hellespont in one hour and ten minutes, used his poetic license to pat himself on the back:

> "How many times have I
> Cloven with an arm still lustier, breast more daring,
> The wave all roughen'd; with a swimmer's stroke
> Flinging the billows back from my drench'd hair,
> And laughing from my lip the audacious brine,
> Which kiss'd it, like a wine cup, rising o'er
> The waves as they arose, and prouder still
> The loftier they uplifted me."

THE FIRST STROKES

Swimming is as old as animal life itself. Walking, swimming, and flying are in reality only modifications of each other. Almost all quadrupeds can swim the first time they are immersed. They have no new actions to learn. Observation would, however, disclose the fact that monkeys and man do not possess an innate ability to swim. The art must be acquired by mastering new movements and a horizontal position. Swimming is very largely a process of learning. According to John B. Watson, the new-born infant placed in water at body temperature, head above the surface, gives no general response. Plunged in cold water, there is violent bodily response but no movements even approximating swimming.[42]

Experience teaches that children left to themselves and eager to swim and having no one to imitate generally adopt a method similar to the manner of progression used by quadrupeds, namely, the dog paddle. It is probable that dog fashion was the first swimming stroke. It is undoubtedly the nearest approach to a natural way of swimming and because it is but a few steps from this position to the crawl stroke, instructors have good reason to believe that the crawl is the most easily taught stroke.

As a result of the asceticism of the Middle Ages, swimming and all other sports suffered a relapse. However, Vittorino da Feltre (1378–1446), an Italian, incorporated in his school some of the knightly practices—wrestling, running, and swimming.[43] Many others followed suit. The gymnastic work and pioneer education performed by our greatest leaders in physical education overshadowed their interests in swimming. But Basedow (1723–1790), Guts Muths (1759–1839), Jahn (1778–1852), Spiess (1810–1858) of Germany, and Ling (1776–1839) and his successors in Sweden and Denmark, carried on swimming programs. No one who could not display some art in swimming was allowed to graduate from the Central Institute in Stockholm.[44]

From dog fashion, swimming proceeded to the breast stroke in honor of the aquatic star, Mr. Frog. Until 1800 the breast stroke was con-

sidered the fastest stroke. So popular was the stroke that in 1865 at the Polytechnic, Regent Street, London, a machine was invented upon which a person could spread himself in the breast swimming position, placing his hands and feet into strap loops on plates which were so constrained by mechanism that when the swimmer moved his hands and feet they were guided in the proper course for breast-stroke swimming. Cassell's *Family Magazine* illustrated this mechanized aquatic coach in 1880.

About 1800, the side stroke came into prominence as a racing stroke. H. Kenworthy, teacher of swimming at the National Baths in London, wrote in 1886 in *A Treatise on the Utility of Swimming* containing instructions in the acquirement of the art, with various anecdotes of celebrated swimmers, as follows: "Until within the last few years it was generally supposed that Breast or Belly swimming was the swiftest process, but this opinion has proved fallacious. The side stroke is now universally acknowledged as the superior method and young swimmers would do well to practice it accordingly. The side stroke is rather peculiar. The body is disposed sideways, as near as possible to the surface of the water; the left arm is thrown out boldly in front, the body springing at the same time to the stroke; the right arm is worked laterally along the side with a sort of paddle action, the palm of the hand being hollowed so as to scoop the water, as if the swimmer were pulling himself along by it. The stroke of the legs should be long and vigorous, crossing each other in the action and working well together with the upper extremities."

Pettigrew,[45] 1883, described the side stroke as the most useful, graceful, and effective yet devised. In still water, he maintained a swimmer should be able to complete a mile in thirty to thirty-five minutes.

The next stroke to appear, the "English Overarm," is a true side stroke with the exception that the upper arm at the completion of the "pull" is returned to its original position by an overarm motion which raises the arm out of the water. (In the side stroke the arm remains under water.) This stroke was introduced by the Lancashire swimmers in England and was known as the Northern Kick.

In 1873, John Trudgeon introduced the stroke which bears his name.[46] It is said he acquired this method of swimming on a visit to South America. It was known to Clias, a writer on swimming, who described it in 1825 as "The Thrust." The speed derived from the Trudgeon stroke gave it preëminence over the breast and side strokes. The founder of the trudgeon swam with his head out of water, but successors found it less laborious when the head was submerged. By 1900, the trudgeon was "the" racing stroke, and even after the innovation of the "crawl" retained its popularity for many years. A writer in 1883 described the trudgeon as "most expeditious but most fatiguing and only possible for short distances."[47]

The crawl stroke is a further evolution in swimming. It is a first cousin to the trudgeon. South Sea Islanders are generally credited as the originators of this method of aquatic propulsion. It was introduced into Australia about 1900 by Aleck Wickham, a native of the Solomons, who had taken residence in Sydney. The Cavill brothers became its first protagonists. The value of the flutter kick was discovered when one of the Cavills swam the trudgeon with his feet tied and made better time than ever.[48] This paradoxical outcome demonstrated the need for a more efficient leg drive than that afforded by the scissors kick.

Duke Kahanomoku, of Hawaii, used the crawl in achieving startling, record-breaking feats. Investigations in Hawaii and the Solomons led to the discovery that the crawl had been in common use in both island groups as far back as the oldest inhabitants could recall (according to L. deB. Handley.[49]

Previous to 1902, the crawl was not generally known in England. When Richard Cavill came from Australia to compete in the English championships, the crawl was popularly adopted as the favorite racing stroke. "Dick" Cavill was the first swimmer to cover the one hundred yards in less than a minute. He used a two-beat kick, still known as the Australian crawl, which is now obsolete.

C. M. Daniels, noted American swimmer, studied the crawl in England and introduced it into the United States. He became the World's Amateur Champion, lowering all former records with the new stroke. However, Daniels did not adopt the two-beat kick. In preference, he copied Kahanomoku who had at first used a four- and then a six-beat thrash. L. deB. Handley, O. Wahle, C. M. Daniels, and F. J. Sullivan are names famous for the promotion of the crawl stroke in America.

EARLY LITERATURE

The first book published on swimming was issued in 1538. It was written in Latin by N. Wynman, a German Swiss Professor of Languages at Ingolstadt. The first treatise published in England was that of Everard Digby, in 1587. It too was written in Latin and was styled *de Arte Natandi.* It was quaintly illustrated with wood cuts.

Other books were then published as follows:

1658. *The Compleat Swimmer* by William Pearcey Gent. This was a sheer plagiarism of Digby's book.
1789. *The Art of Swimming with Advice to Bathers.* It was written by Thevenot, a Frenchman, who, Ralph Thomas says, could not swim a stroke.
1816. *Unterricht in der Schwimmkunst* by Carl Heintz.
1817. Pfuel, an expert swimmer, described the side stroke in a pamphlet.
1827. Tetzer, a pupil of Guts Muths, wrote a small book on swimming.
1828. *Beknopte Hanleiding* by G. Ypma.
1831. F. Nachtegall, *Lehrbuch der Gymnastik*, pages 17, 37, 88, and 93. State aid was given to make the publishing of this book possible and available to all schools in Denmark.
1850. *Essays on the Art of Swimming* by Dr. Franklin, London.

1857. *Instruction fur den Schwimm—Unterricht in der Franzosischen Armee*, by d'Argy. Printed in Berlin.
1867. *The Manual of Swimming* by Steadman. Printed in Melbourne. *Manual of Physical Exercises* by William Wood. Printed in New York.
1873. *Land Drills* by Auerbach. "How to teach a large number of pupils at one time." *Instruction for Those Without a Teacher* by Ladebeck.
1879. *Schwimmkunst gestutzt Auf natur-wissenschaft liche Principien* by Adolf Graf Von Buonaccorse Pisloja.
1880. *Des Ganze der Schwimmkunst* by A. C. Schoffman. Printed in Munchen.
1883. *The Swimming Instructor* by W. Wilson.
1886. *A Treatise on the Utility of Swimming* by H. Kenworthy.
1887. *The Athlete's Guide*, pages 50–56, by Jackson and Godbold.
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A more complete bibliography of the early literature of swimming may be found in *Swimming* by Sinclair and Henry.

THE OLYMPICS

The world was very slow to recognize the importance of swimming and many forms of athletics had grown old before swimming was placed on the International Sports Calendar. The Early Olympics which date back to 776 B.C. included foot races, boxing, wrestling, horse races, and chariot races. Even when Baron de Coubertin revived the Olympics in Athens in 1896, swimming was not included in the official list of sports. However, when Athens was again host to the Modern Olympics in 1906, four swimming events for men were included. These were the 100 meters, 400 meters, and 1600 meters (all free style), and a 1,000-meter team race, which were respectively won by C. M. Daniels, U.S.A., in 1′ 13″; Sheff of Austria in 6′ 23⅘″; Taylor of Great Britain in 28′ 28″; and the Hungarian team in 16′ 52⅖″.[50] The same year diving from the 4- and 12-meter boards was added. Walz of Germany was champion in these events. In 1908, the 100-meter back and the 200-meter breast were made additional events. The 1600-meter breast was changed to 1500, and 800 meters became the distance for the team race. In 1912, water polo and the 400-meter breast stroke were added and women were admitted as competitors.[51] The women's events were 100 meters, high diving, and 400-meter team race. The inclusion of women in Olympic swimming competition was the most radical change since swimming became an Olympic sport. Minor changes and additions have been made since 1912 all of which have tended to strengthen the swimming program.

From 1910 to 1928, United States stood supreme in Olympic swimming, but their margin of winning grew less until last year when they were decisively defeated by Japan by 86–33. Many new records were made and the Japanese have provided much food for thought on the matter of training and diet, the advantages or disadvantages of adipose tissue, of bigger feet and longer and heavier legs, of buoyancy, of height, weight, vital capacity, etc. The Japanese did not introduce a

new stroke, but to the casual observer their success would seem due to more conscientious and enthusiastic training and discipline.

CHANNEL SWIMMING

Swimming the English Channel has always been a sporting event attracting world-wide attention. Previous to 1832, Dr. Franklin, an American, who had written out several precautions to be observed to avoid drowning[52] suggested that the channel might be crossed by a swimmer floating on his back and holding one leg perpendicular to which a sail might be attached. "The Packet Boat," Dr. Franklin observed, "is still preferable."[53]

The first recorded attempt to swim the channel was made on August 24, 1872, by J. B. Johnston. He was in the water sixty-five minutes. Captain Mathew Webb was the first to succeed. He made the crossing on August 24 and 25, 1875, having made one unsuccessful attempt. His time was twenty-one hours and forty-five minutes. He was drowned attempting to swim Niagara rapids.

Other successful attempts have been:

T. W. Burgess	Sept. 6, 1911	21 hours	35 min.
H. Sullivan	Aug. 6, 1923	20 hours	50 min.
S. Tirabosche	Aug. 12, 1923	16 hours	35 min.
C. Toth	Sept. 9, 1923	16 hours	54 min.
Miss G. Ederle	Aug. 6, 1926	14 hours	31 min.
Mrs. C. Corson	Aug. 28, 1926	15 hours	28 min.
H. Yierkotter	Aug. 30, 1926	12 hours	40 min.
G. Michel	Sept. 10, 1926	11 hours	5 min.
N. L. Durham	Sept. 17, 1926	13 hours	56 min.
E. H. Temme	Aug. 5, 1927	14 hours	29 min.
Miss M. Gleitze	Oct. 7, 1927	15 hours	15 min.
Mrs. Ivy Gill	Oct. 13, 1927	15 hours	9 min.
Miss Ivy Hawke	Aug. 19, 1928	19 hours	16 min.
Miss Hilda Sharp	Aug. 24, 1928	14 hours	58 min.
I. Helmy	Sept. 1, 1928	23 hours	40 min.
Miss Sunny Lowry	Aug. 28, 1933	15 hours	45 min.
E. H. Temme	Aug. 18, 1934	15 hours	55 min.
Miss Emma Faber	Aug. 18, 1934	14 hours	8 min.

Webb, Burgess, and Sullivan swam from England to France. The remainder swam from France to England.

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Committee Report on Showers for Boys and Men*

By Franklin J. Gray
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INTRODUCTION

THE OUTSTANDING fault in planning for physical education facilities is the inadequacy of space and equipment allowed for shower- and dressing-rooms. The officials who plan school buildings frequently do not appreciate the administrative problem of giving sufficient space for dressing and showering large groups of students in a short space of time.

As a matter of fact there are many schools that possess good gymnasiums, but the shower facilities are so meager that no attempt is made to give the students a shower after vigorous work in the physical education classes.

This procedure is not only bad hygiene, but it also creates on the part of many students a distaste for the program. It is, therefore, highly important that all students taking vigorous work in physical education activities have opportunity for a cleansing and refreshing shower bath immediately following their class work.

This monograph gives all the essential information needed to provide adequate shower facilities for a group of seventy pupils. For larger or smaller groups the equipment could be increased or decreased proportionately.

Included in this monograph are three distinctive shower-room arrangements selected by the health education directors of three cities. These plans are considered by the directors in the different cities, as the most satisfactory types.

SPACE AND EQUIPMENT BASED ON A GROUP OF SEVENTY

Shower-Room.—The minimum size of the shower-room should be twenty by forty feet. This dimension makes a satisfactory room, particularly for central control and for a maximum number of showers.

Shower Heads.—The minimum number of shower heads should be thirty. The space between shower heads should be three feet. This space

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* A paper presented before the Public Schools Section at the American Physical Education Association Convention, April, 1935, at Pittsburgh, Pa.

allows two boys to use the same shower at the same time. The height from the floor depends upon two factors: (1) age of pupils and (2) location of shower. The most common procedure is to place the heads on the side of the wall, low enough so that a pupil may shower without wetting the head, if he so desires.

Side-wall showers may range from fifty-six inches to seventy-two inches from the floor, depending on the size of pupils. If showers are placed overhead it is desirable to put them high enough so that they cannot be reached by the pupils.

There are several objections to the overhead shower and unless there are unusual reasons for placing them in this manner, directors of physical education are advised to seriously consider the other plans.

The Rochester, New York, plan is called the "rain shower." The water comes from overhead, nine feet from the floor, and the entire room is sprayed. A pupil cannot enter this type of shower-room without getting wet. The writer has not seen this type of shower in practice. Mr. Herman J. Norton, however, would be glad to give you more detailed information. A plan of this room is attached to this monograph.

There are several types of shower heads. One of the latest is the Speakman Adjusta-Spray Shower Head. A complete description of different types of shower heads is given in the booklet, "Shower Heads and Showers," by the Speakman Company. Because of this complete description by Speakman, no further description will be given here.

Shower Control.—There are three distinct types of shower control: (1) individual, (2) central, and (3) combination of individual and central.

The best practice for large groups is to have most of the showers under one central control with a few under individual control, which may be used by small groups without turning on all the showers. This makes for economy. Another good practice is to have a cut-off valve which, when shut, will cut off half the showers. This is a good plan when the size of the groups varies from thirty to seventy. Individual control is not the best arrangement for large groups in secondary or lower schools.

Soap.—The best arrangement for soap is to install several large tanks of liquid soap, elevated so that individual outlets may be placed between the showers. This plan avoids waste and also the danger that may come from throwing soap, stepping on it, or the use of one cake by several pupils.

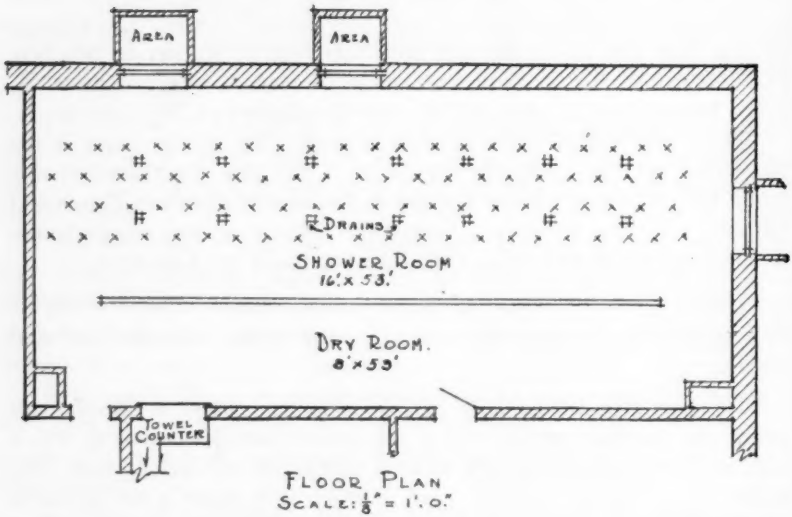
Towels.—The ideal practice is to have the school furnish each pupil, without charge, a clean towel every time he takes a shower. Some schools request the pupil to bring his towel. The tendency in this plan is for the pupil to use the same towel several times, or even for an entire semester, without the towel being laundered.

Some schools furnish clean towels, but charge the students a fee. Paper towels are impracticable when used as a bath towel.

Drying-Room.—It is very desirable to have a drying-room directly adjacent to the shower-room. Boys may dry in this room, put their damp towels in a container and go to the dressing-room without carrying in a lot of water. The minimum size of a drying-room should be fifteen by thirty feet.

SHOWER-ROOM PLANS

No. 1 Shower Room Plan
John Marshall High School
Herman J. Norton, Director of Health Education
Rochester, New York.



Note: 84 shower heads, 9 feet from floor.
Master control.
Twelve additional shower heads in another room for smaller groups.

1—Rain Shower—Rochester, New York
Herman J. Norton, Director of Health Education, Board of Education, Rochester, New York

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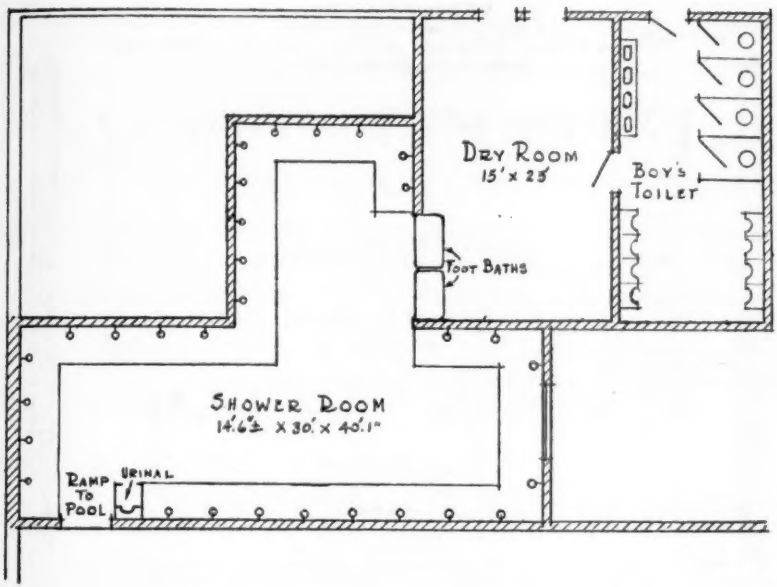
Crane Company, 8365 Michigan Avenue, Chicago, Illinois
Speakman Company, Wilmington, Delaware

No. 2 Shower Room Plan
Central High School
Walter E. Short, Director of Health and Physical Education
Trenton, New Jersey



Pool
Floor Plan
Scale ⅛" = 1'.0"

Note: 30 shower heads, 6 feet from the floor, and 38 inches apart. Individual control.

2—Wall Showers—Trenton, New Jersey—Speakman Head Type
Walter E. Short, Director of Health Education, Board of Education, Trenton, New Jersey

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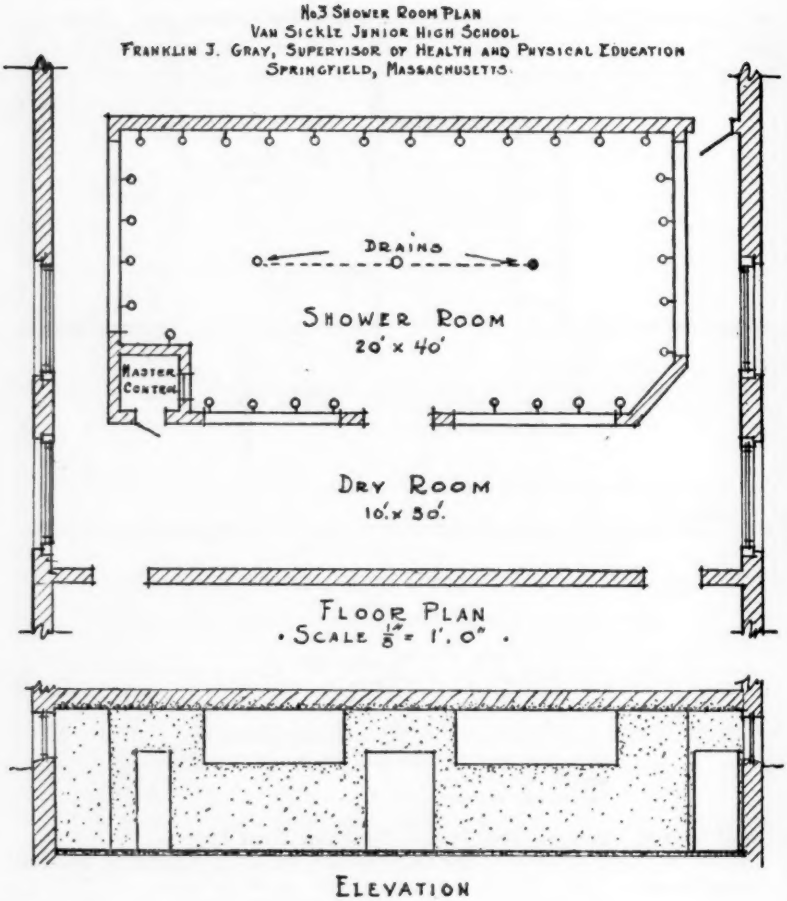


Note: 30 Shower heads - 56 inches from floor
Side wall - 30 inch spacing
Shower wall six feet high, leaving a three foot space open at the sides for better ventilation.

3—Wall Showers—Speakman Head Type—Combination Control
Franklin J. Gray, Supervisor Health and Physical Education, Administration Building, Springfield, Massachusetts

Physical Education Knowledge Tests

Developed by the Department of Physical Education for Women, University of Minnesota

Catherine Snell, *Chairman*

PART II. TESTS IN TEAM AND INDIVIDUAL SPORTS

THE TESTS printed below were compiled and tested for reliability and validity by the Department of Physical Education for Women at the University of Minnesota, in the spring of 1932, and have been revised three times thereafter. The description of the procedure employed in setting up these tests, and the tests in hygiene, fundamentals, archery, and hockey, were published in the RESEARCH QUARTERLY for October, 1935.

VOLLEYBALL

Directions.—After each statement there are five words or groups of words in parentheses each preceded by a letter. You are to write in the space indicated on the answer sheet the letter of the *one* word or group of words that makes the truest or best statement. If a wrong letter is given as well as the right one in any given statement, no credit will be given for that statement. If you do not know the correct statement, do *not* guess.

1. An official volleyball game consists of (*a.* four fifteen-minute quarters; *b.* two thirty-minute halves; *c.* four seven-minute quarters; *d.* two fifteen-minute halves; *e.* four ten-minute quarters).

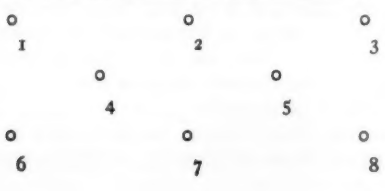
2. When the team serving fails to win its point or plays the ball illegally it is called (*a.* point; *b.* dead ball; *c.* side out; *d.* out-of-bounds; *e.* dribbling).

3. The teams shall change courts (*a.* after every service; *b.* after twenty-one points have been scored; *c.* at the end of a game; *d.* at the end of the half; *e.* after eleven points have been scored).

4. The number of players on an official team is (*a.* six; *b.* seven; *c.* eight; *d.* nine; *e.* eleven).

5. The height of a volleyball net should be (*a.* "a racquet and a half"; *b.* twice as high as the players are tall; *c.* 3 ft. 6 in.—4 ft. at the center; *d.* 6 ft. 6 in.—7 ft. 6 in. at the center; *e.* never more than 6 ft. for girls).

USE THIS DIAGRAM FOR QUESTIONS 6-8:



6. Number 5 is called (*a.* right back; *b.* left forward; *c.* right forward; *d.* left back; *e.* right center).

7. Player number 8 rotates to the position of player no. (*a.* three; *b.* six; *c.* one; *d.* four; *e.* seven).

8. Player number 5 rotates to the position of player number (*a.* four; *b.* two; *c.* three; *d.* eight; *e.* six).

9. Score is *A*-18, *B*-16. *A* is serving. The ball is returned by *B* team, a player on team *A* hits the ball twice on returning it over the net to the opponents' court, and team *B* fails to get it back to team *A*. Score (*a. A*-19; *B*-16; *b. A*-18; *B*-16; *c. A*-18; *B*-19; *d. A*-18; *B*-15; *e. A*-19; *B*-15).

10. A high slow ball passed to a teammate who is in better position to return the ball over the net is called (*a.* a set up; *b.* a legal return; *c.* dribbling; *d.* a return; *e.* a net service).

11. To serve the ball the player must stand (*a.* anywhere behind the end line; *b.* behind the right half of the end line; *c.* behind the left one-fourth of the end line; *d.* behind the right one-third of the end line; *e.* behind the left half of the end line).

12. The number of players who may touch the ball on the service is (*a.* one; *b.* two; *c.* three; *d.* four; *e.* unlimited).

13. Team *A* is serving. Players from both teams touch the net simultaneously. The referee calls (*a.* side out; *b.* point; *c.* reservice; *d.* net ball; *e.* time out).

14. After "point" or "side out" the ball is (*a.* set up; *b.* dribbled; *c.* out-of-bounds; *d.* in play; *e.* dead).

15. Putting the ball into play by batting it over the net into the opponents' court is called (*a.* playing the ball; *b.* serving order; *c.* making a point; *d.* serving; *e.* receiving).

16. The ball must be replayed if (*a.* one player commits a foul; *b.* two players on same team commit fouls simultaneously; *c.* two players on opposing teams commit fouls simultaneously; *d.* one player on the serving team touches the net; *e.* one player on the receiving team touches the net).

17. In making a good service one should (*a.* serve swiftly and to an unguarded area; *b.* send a swift ball just over the top of the net and parallel with floor so backs will have to return it; *c.* send ball high in the air to be sure it does not go over the end line; *d.* send the ball to the centers; *e.* serve a slow ball since the service is only a means of putting the ball into play).

18. The ball may be recovered from the net if (*a.* an opponent has sent the ball to the net on a return; *b.* one does not reach over or under the net; *c.* a teammate has caused the ball to go to the net on the service; *d.* the second serve results in a net service; *e.* on a return, the player avoids touching the net).

19. Score is *A*-3; *B*-2. *A's* team is serving. *B's* team returns the ball and someone on *A's* team touches the net. Score is (*a. A*-2; *B*-3; *b. A*-4; *B*-2; *c. A*-3; *B*-2; *d. A*-2; *B*-2; *e. A*-3; *B*-4).

20. Score is 10-10. *A's* team is serving. *A* returns the ball which hits the net, but goes over into the opponents' court and touches the ground before anyone on *B's* team touches it. Score is (*a. A*-10; *B*-10; *b. A*.10; *B*-11; *c. A*-9; *B*-11; *d. A*-9; *B*-10; *e. A*-11; *B*-10).

21. Score is *A*-5, *B*-4. Team *B* is serving. The player on team *A* in attempting to keep the ball from bounding on the ground hits the ball up in the air three times before finally returning it over the net. Team *B* smashes the ball back so hard that team *A* cannot return it again. Score is now (*a. A*-4; *B*-4; *b. A*-6; *B*-4; *c. A*-6; *B*-5; *d. A*-5; *B*-5; *e. A*-5; *B*-3).

22. Team *A* is serving. The player in the right back position serves the ball and team *B* makes a legal return which team *A* fails to return over the net. The

referee declares (*a.* point; *b.* dead ball and team *A* rotates to allow a new server to serve; *c.* point and the same server serves again; *d.* side-out and team *B* rotates to allow a new server to serve; *e.* side out and the person in the right back position on team *B* serves).

23. The first server on the second team to serve is the girl who started in the (*a.* right back position; *b.* center back position; *c.* left back position; *d.* left forward position; *e.* right forward position).

24. When returning a ball which is above the head one should (*a.* use right hand only; *b.* use left hand only; *c.* use both hands with little fingers together; *d.* use both hands with thumbs together; *e.* use both hands with heels of hands together).

25. Positions within a team may be changed (*a.* any time; *b.* only at the end of a quarter; *c.* only at the beginning of a quarter; *d.* whenever a side-out or point has been called; *e.* only at the end of a half).

26. Score is *A*-10, *B*-10. Team *A* is serving. *A* player on team *B* catches the ball but releases it immediately to the opponents' court and team *A* fails to return it. Score is (*a.* *A*-10; *B*-11; *b.* *A*-10; *B*-9; *c.* *A*-11; *B*-11; *d.* *A*-9; *B*-10; *e.* *A*-11; *B*-10).

27. If the server fails to serve a good ball she may have a second trial (*a.* after she has made one point; *b.* at the beginning of her term of service; *c.* if she has served out of bounds; *d.* if one of her teammates touched the net; *e.* after twenty-one points have been served).

28. A team rotates (*a.* after they make a point; *b.* after side-out is called for their team; *c.* after the opposing team makes a point; *d.* after the opposing team has had two serves; *e.* after "side-out" is called for the opposing team).

29. Team *A* serving. Team *B* fails to return the ball legally; the referee declares (*a.* side-out; *b.* out-of-bounds; *c.* dead ball; *d.* point; *e.* rotation).

30. When the receiving side fails to return the ball legally to the opponents' court it is called (*a.* side-out; *b.* point; *c.* illegal return; *d.* out-of-bounds play; *e.* dead ball).

31. The ball may be batted in any direction in the following manner (*a.* with any part of the body; *b.* with one hand only; *c.* with any part of the body above the waist; *d.* with one or both hands only; *e.* with two hands, one hand being illegal).

32. A team scores only when it has (*a.* received the ball; *b.* returned the ball; *c.* set up the ball; *d.* dribbled the ball; *e.* served the ball).

33. Score is *B*-2, *A*-3. *B*'s team is serving. *A*'s team returns the ball which touches the ceiling and lands on the floor in the opposite court. Score is (*a.* *B*-2; *A*-3; *b.* *B*-3; *A*-3; *c.* *B*-2; *A*-4; *d.* *B*-4; *A*-4; *e.* *B*-3; *A*-4).

34. The lines on the short sides of the court are called the (*a.* back lines; *b.* side lines; *c.* center lines; *d.* end lines; *e.* goal lines).

35. If a person touches the ball or is touched by the ball it is called (*a.* side out; *b.* point; *c.* out-of-bounds; *d.* dead ball; *e.* playing the ball).

36. The term applied to the shifting of players for each new service is (*a.* net service; *b.* rotation; *c.* serving order; *d.* return; *e.* side out).

37. Score is *B*-10, *A*-5. Team *B* is serving. Team *A* returns the ball. The center forward on team *B* in an effort to make a swift return hits the ball before it crosses the net. Score is (*a.* *B*-11; *A*-5; *b.* *B*-10; *A*-6; *c.* *B*-10; *A*-5; *d.* *B*-9; *A*-4; *e.* *B*-11; *A*-6).

38. The set up is used (*a.* to assist the service; *b.* to insure teamwork; *c.* as a defensive play; *d.* to make possible an effective return; *e.* to use a tall player to greater advantage).

39. Time out may be called by (*a.* referee only; *b.* captain only; *c.* any player; *d.* coach of the team only; *e.* coach or captain of team).

40. The first service is a net ball; the second service is a net ball. The referee calls (*a.* side out; *b.* illegal service; *c.* point; *d.* out-of-bounds; *e.* net service).

41. Team *A* is serving. Team *B* returns the ball to team *A*, and a player on team *A* sets up to the teammate in the left forward position. The left forward smashes the ball over the net. The ball hits the referee. The referee calls the following decision (*a.* illegal return; *b.* dribbling; *c.* side out; *d.* point; *e.* dead ball).

42. Team *A* is serving. Score is *A*-10, *B*-2. Player on team *B* returns the ball and steps over the center line after the ball touches the floor in *A*'s court. Score is (*a.* *A*-10; *B*-2; *b.* *A*-11; *B*-2; *c.* *A*-10; *B*-3; *d.* *A*-11; *B*-3; *e.* *A*-10; *B*-1).

43. The defensive players on a volleyball team are the (*a.* backs and centers; *b.* right and left centers; *c.* server and anyone who assists her; *d.* center forward and right and left centers; *e.* the three forwards).

44. The best defense is to (*a.* serve a swift ball; *b.* "kill" an opponent's service; *c.* receive the ball and pass it at least twice before returning; *d.* play the ball to an open spot in opponents' court; *e.* receive accurately and control ball for attack).

45. The attack or offensive players on a volleyball team are the (*a.* center forward and right and left centers; *b.* the server and anyone who assists her service; *c.* the three forwards; *d.* the three backs; *e.* any players who succeed in playing the ball on a return).

SOCCER

Directions.—After each statement there are five words or groups of words in parentheses each preceded by a letter. You are to write in the space indicated on the answer sheet the letter of the *one* word or group of words that makes the truest or best statement. If a wrong letter is given as well as the right one in any given statement, no credit will be given for that statement. If you do not know the correct statement, do *not* guess. Print the answers in capital letters. Do not write on the question sheet. Place number of question sheet on each answer sheet.

1. On a free kick all opponents must be (*a.* three yards away; *b.* four yards away; *c.* five yards away; *d.* six yards away; *e.* seven yards away).

2. The throw-in is most frequently taken by (*a.* outside forward; *b.* center forward; *c.* center halfback; *d.* inside forward; *e.* halfback on side where breach occurred).

3. The chief duty of the forward line is to (*a.* keep the ball; *b.* follow the ball; *c.* make goals; *d.* get the ball away from opponents; *e.* kick the ball).

4. If the attack sends the ball over the touch line near the center of the field, play is resumed by (*a.* the center forward taking a free kick at the place where the ball went out; *b.* the halfback on side of field where ball went out taking free kick at place where ball went out; *c.* center halfback taking a throw-in; *d.* halfback on side of field where ball went out taking throw-in; *e.* fullback taking a free kick at spot where ball went out).

5. After a score has been made, the ball is always put in play by (*a.* the team making the score; *b.* the team scored against; *c.* the team with lower score; *d.* the team with the higher score; *e.* alternate teams).

6. No score is counted if the ball (*a.* touches the goal posts on its way through goal; *b.* goes under the cross bar; *c.* is headed between the goal posts under the cross bar; *d.* is kicked over the goal line under the cross bar; *e.* stops on the goal line).

7. When the defense sends the ball over the goal line, not between the goal posts, the attack is awarded a (*a.* free kick; *b.* goal kick; *c.* penalty kick; *d.* corner kick; *e.* throw-in).

8. The left outer is marked or guarded by the (*a.* left outer on the opposing

team; *b.* right outer on the opposing team; *c.* left halfback on the opposing team; *d.* right halfback on the opposing team; *e.* right fullback).

9. On a regulation soccer team there are (*a.* three center forwards; *b.* two fullbacks; *c.* one halfback; *d.* four outers; *e.* two goalkeepers).

10. The defense center half outside the penalty area pushes her opposing center forward away from the ball. The attack should be awarded a (*a.* penalty kick; *b.* throw-in; *c.* goal kick; *d.* corner kick; *e.* free kick).

11. A free kick may be taken (*a.* only at the center of the field; *b.* for out-of-bounds balls; *c.* only on the six-yard line; *d.* anywhere on the field; *e.* only in the direction of the opponents' goal).

12. A player intercepting a pass hits the ball with the top of her shoulder. The decision is (*a.* free kick for opponents; *b.* corner kick for opponents; *c.* ball dropped between two opposing players; *d.* legal play and game continues; *e.* throw-in for opponents).

13. From the following groups select the best combination of players who play both offensively and defensively: (*a.* center forward, right inside forward, left fullback; *b.* center halfback, right halfback, goal keeper; *c.* center halfback, right halfback, left halfback; *d.* center halfback, right halfback, center forward; *e.* right halfback, center forward, right wing).

14. A ball which has been sent over the goal line not between the goal posts by the attack must be (*a.* returned to play by a throw-in; *b.* kicked into field from the goal line; *c.* drop kicked by the goal keeper; *d.* kicked from the six-yard line; *e.* drop kicked by a halfback).

15. The left outer in receiving a throw-in from the left halfback, uses her arms to stop the ball. The defense should be awarded a (*a.* penalty kick; *b.* throw-in; *c.* free kick; *d.* corner kick; *e.* goal kick).

16. A penalty kick is taken (*a.* any place on field where foul occurs; *b.* on the goal line; *c.* on the six-yard line; *d.* on a line twenty-five yards from the goal line; *e.* on a line twelve yards from and directly in front of goal).

17. In general the fullbacks' area of play is from (*a.* their own goal line to the opponents' goal line; *b.* their own penalty area line to center field; *c.* their own goal line to opponents' penalty area line; *d.* their own goal line to center line; *e.* their own penalty area line to their opponents' goal line).

18. The right halfback in taking a throw-in fails to start the throw from a position overhead. The referee makes the following decision: (*a.* free kick by the opposing left halfback; *b.* throw-in by the opposing left halfback; *c.* throw-in by opposing right halfback; *d.* throw-down between the two opposing halfbacks; *e.* corner kick taken by the opposing left halfback).

19. A halfback in taking a free kick causes the ball to go in a backward direction by using her heel. The decision is (*a.* illegal play and free kick awarded opponents; *b.* illegal play and throw-in awarded opponents; *c.* illegal play and penalty kick awarded opponents; *d.* legal play and game continues; *e.* illegal play and ball is dropped between two players).

20. A player in throwing a ball in from the touch line raises her heels from the ground. The decision is (*a.* illegal throw and must be taken over again; *b.* legal throw and ball is in play; *c.* illegal throw and ball is given to opposing player for throw-in; *d.* illegal throw and opposing side awarded a free kick; *e.* illegal throw and ball is dropped between two players).

21. If the defense makes a foul inside the penalty area the attack is awarded a (*a.* free kick; *b.* penalty kick; *c.* corner kick; *d.* goal kick; *e.* throw-in).

22. If a member of the team taking the kick off crosses the line ahead of the ball after a warning, the opponents are awarded (*a.* throw-in; *b.* free kick; *c.* penalty kick; *d.* kick off; *e.* corner kick).

23. The left halfback in throwing in a ball from touch causes it to go between the goal posts without being played by another player. The decision is (*a.* score does not count and opposing team is given a free kick; *b.* score counts and game is resumed by kick off; *c.* score does not count and game is resumed by throw-in for opposing side; *d.* score not counted and game is resumed by goal kick by opposing side; *e.* score counts and game is resumed by drop ball).

24. The goal keeper uses her hands outside the penalty area. The attack should be awarded a (*a.* free kick; *b.* penalty kick; *c.* goal kick; *d.* throw-in; *e.* corner kick).

25. A ball kicked by an attacking player glances off the leg of a defending fullback and goes into the goal. The ball is put in play by a (*a.* goal kick; *b.* corner kick; *c.* kick off; *d.* free kick; *e.* throw-in).

26. The penalty for offside is (*a.* free kick; *b.* goal kick; *c.* throw-in; *d.* warning; *e.* penalty kick).

27. If the attack makes a foul inside the penalty area the defense is awarded a (*a.* free kick; *b.* penalty kick; *c.* corner kick; *d.* goal kick; *e.* throw-in).

28. The penalty kick is usually taken by the (*a.* center halfback; *b.* right outside forward; *c.* center forward; *d.* left halfback; *e.* fullback).

29. On a penalty kick both the defense and attacking teams should stand (*a.* behind the goal line; *b.* inside the penalty area; *c.* outside the penalty area; *d.* along the six-yard line; *e.* lined up as at beginning of game except for player taking the kick).

30. The ball is in general play on the kick off (*a.* after it has been rolled over once in the direction of opponents' goal; *b.* as soon as the whistle blows; *c.* as soon as it is wholly within opponents' territory; *d.* when the forwards have crossed the center line; *e.* after it has been kicked once in any direction).

31. In general the forwards' area of play is from (*a.* their own penalty area to the opponents' penalty area; *b.* their own goal line to the opponents' goal line; *c.* the center line to the opponents' goal line; *d.* their own penalty area to the opponents' goal line; *e.* their own penalty area to the center line).

32. In attempting to gain possession of the ball the right inside and her opposing left fullback both touch the ball as it goes out-of-bounds. The ball is put in play by (*a.* toss-up; *b.* free kick; *c.* kick off; *d.* drop ball; *e.* throw-in).

33. The "attacking team" refers to the team that (*a.* is nearest opponents' goal post; *b.* has possession of the ball; *c.* does not have possession of the ball; *d.* has the lowest score; *e.* is the roughest).

34. In a correct throw-in (*a.* the ball is thrown with one hand using the other to direct it; *b.* force is added by using straight arm overhead throw; *c.* both feet must be behind the line until the ball leaves the hands; *d.* both feet must remain flat on the ground; *e.* part of both feet must be on the line until the ball leaves the hand).

35. The goal kick is taken from the (*a.* goal line; *b.* six-yard line; *c.* half-way line; *d.* penalty line; *e.* touch line).

36. If after taking a free kick that player kicks the ball again before another player touches it the opposing team is awarded a (*a.* throw-in; *b.* goal kick; *c.* corner kick; *d.* penalty kick; *e.* free kick).

37. A corner kick is awarded when the (*a.* attack sends the ball over the end line near the corner; *b.* defense sends the ball over their opponents' end line; *c.* defense sends the ball over their own end line; *d.* attack makes a foul in the penalty area; *e.* defense makes a foul in their own penalty area).

38. The right fullback inside her own penalty area deliberately trips her opposing left inside. Her opponents should be awarded a (*a.* free kick; *b.* throw-in; *c.* goal kick; *d.* corner kick; *e.* penalty kick).

39. A goal kick is a (*a.* kick taken by the attack directly in front of the goal following a foul by the defense; *b.* kick from anywhere on the field which goes between the goal posts; *c.* kick made by the goal keeper in defending her goal; *d.* kick given to the defenders on the six-yard-line following an out-of-bounds ball; *e.* kick taken from the penalty line that goes between the posts).

40. The corner kick is usually taken by the (*a.* center forward; *b.* inside forward; *c.* center halfback; *d.* outside forward; *e.* halfback on side of field where breach occurred).

41. A goal kick is usually taken by the (*a.* goal keeper or fullback; *b.* fullback or halfback; *c.* halfback on side of field where breach occurred; *d.* center halfback; *e.* center forward).

42. The right fullback marks or guards the (*a.* right inside on opposing team; *b.* left inside on opposing team; *c.* right halfback on opposing team; *d.* left outside on opposing team; *e.* left halfback on opposing team).

43. A ball that is dropped from the hands and kicked before it touches the ground is called (*a.* drop kick; *b.* goal kick; *c.* scoring kick; *d.* punt; *e.* corner kick).

44. The left inside is ahead of the ball when it is kicked to her by the center forward. The goal keeper is the only one between her and the goal; the penalty is (*a.* free kick; *b.* goal kick; *c.* throw-in; *d.* warning; *e.* penalty kick).

45. From the following groups select the combination which is most responsible for offensive play: (*a.* center forward, right inside, left fullback; *b.* center forward, right halfback, right outer; *c.* right outer, right inside forward, left fullback; *d.* center forward, right inside forward, left halfback; *e.* left outer, left halfback, left fullback).

BASKETBALL

Directions.—After each statement there are five words or groups of words in parentheses each preceded by a letter. You are to write in the space indicated on the answer sheet the letter of the *one* word or group of words that makes the truest or best statement. If a wrong letter is given as well as the right one in any given statement, no credit will be given for that statement. If you do not know the correct statement, do *not* guess.

1. The most effective way for a forward to evade a guard is to (*a.* pivot; *b.* juggle; *c.* bounce ball and run around partner to recover it; *d.* shoot for basket; *e.* send ball out-of-bounds).

2. All out-of-bounds balls are put in play (*a.* at the side lines; *b.* at the end lines; *c.* anywhere outside the court; *d.* at the spot where the ball crossed the line; *e.* on the end or side line regardless of where the ball crossed the line).

3. A throw should be made so that it comes (*a.* below the knees of the receiver; *b.* above the head of the receiver; *c.* approximately waist high; *d.* directly to the head of the receiver; *e.* with speed regardless of distance it is to travel).

4. Taking more than one step with the ball is called (*a.* personal foul; *b.* obstruction; *c.* carrying on; *d.* traveling; *e.* a technical foul).

5. The most commonly used shot for basket is the (*a.* two-hand overhead; *b.* one-hand overhead; *c.* chest shot; *d.* shot-put shot; *e.* loop shot).

6. Of the following combinations of offenses, the group which exacts the most serious penalties is (*a.* guarding an opponent already guarded, stepping over the line, bouncing the ball twice; *b.* pushing, holding an opponent, blocking; *c.* guarding an opponent already guarded, illegal bounce, stepping over a line; *d.* snatching the ball from an opponent, holding an opponent, combining a bounce and a juggle; *e.* throwing while sitting, snatching the ball, making an illegal bounce).

7. Holding the ball occurs when a player (*a.* puts her hands on the ball when

another player already has possession of it; *b*. retains possession of the ball more than three seconds on the court without bouncing or juggling it; *c*. retains possession of the ball more than three seconds out-of-bounds at the side line; *d*. refuses to let go of the ball when it is held in tie; *e*. throws the ball from a sitting position).

8. A player *A* in attempting to catch a ball puts one hand on it after her opponent *B* has secured it, but she immediately takes her hand off; the referee's decision should be to (*a*. call tie ball; *b*. technical foul on *A*; *c*. allow play to continue; *d*. call time out; *e*. award an out-of-bounds throw to *B*).

9. Of the following combinations, the group which contains more than two methods of legally advancing the ball is (*a*. bouncing, juggling, striking with open hand; *b*. bouncing, juggling, hitting ball with fists; *c*. bouncing, juggling, handing ball to another player; *d*. bouncing, juggling, kicking; *e*. bouncing, rolling, kicking).

10. The penalty for pushing a forward in the act of shooting for basket is always (*a*. an unguarded throw; *b*. one free throw; *c*. one point awarded to team offended; *d*. one free throw if basket is made; *e*. two free throws).

11. A legal bounce is a play in which (*a*. the ball touches the floor once and is regained by the same player; *b*. the ball touches the floor once and rebounds knee height; *c*. the ball touches the floor several times and is regained by a teammate; *d*. the ball touches the floor once and is regained by a teammate; *e*. the ball touches the floor more than once and is regained by the same player).

12. Two forwards of team *A* have between them a guard of team *B* who has the ball. The referee's decision is (*a*. a technical foul on the forward belonging to the guard who has the ball; *b*. a technical foul on the guard for being out of position; *c*. a technical foul for obstruction on the forward not belonging to the guard; *d*. an out-of-bounds ball for the guard; *e*. a technical foul for boxing up—on the forward not belonging to the guard.

13. Choose from the following combinations of fouls the one which would disqualify a player: (*a*. two personal and three technical; *b*. two personal; *c*. four technical; *d*. a combination of four fouls of which the first three are technical; *e*. a combination of four fouls two of which are personal).

14. If at the end of playing time the score is a tie the referee should (*a*. continue playing for three minutes; *b*. continue playing for five minutes; *c*. let the score stand; *d*. ask captain to toss coin for winner; *e*. decide the winner on playing ability).

15. Delaying the game is a (*a*. technical foul; *b*. personal foul; *c*. violation; *d*. decision left solely to the judgment of the referee; *e*. an unclassified foul).

16. A good pass is one which goes (*a*. high; *b*. a great distance; *c*. directly to a teammate; *d*. to a space to which a teammate can run; *e*. below the knees of the receiver).

17. Charging occurs when (*a*. a player pushes another player who has the ball; *b*. a player with the ball pushes her opponent; *c*. a guard comes in personal contact with her forward who has possession of the ball; *d*. a guard pushes a forward who is in the act of shooting; *e*. a jump center pushes the other jump center in the attempt to outjump her).

18. A forward, who is in the act of shooting for a basket, pushes her guard with the ball. The decision is (*a*. the basket if made counts; *b*. two free throws for the guard's team; *c*. charging by the forward; *d*. pushing by the forward; *e*. a technical foul on the forward).

19. The penalty for a violation is always taken (*a*. at a point ten feet in front of the basket; *b*. out-of-bounds on the end lines; *c*. on the spot where the violation occurred; *d*. at a place on the side lines opposite the spot where the violation occurred; *e*. anywhere on the court).

20. Upon receiving the ball on the field of play, it may be held for (*a.* two seconds; *b.* five seconds; *c.* three seconds; *d.* as long as one wishes; *e.* four seconds).

21. A player may be removed from the game when (*a.* she has total of four fouls; *b.* the referee disqualifies her; *c.* she has three technical fouls; *d.* the referee thinks she has committed too many violations; *e.* she has two personal fouls).

22. In case there is a disagreement between scorers during the game they should (*a.* ask the umpire to settle the question; *b.* decide in favor of the larger score; *c.* decide in favor of the smaller score; *d.* ask the referee to settle the question; *e.* call the score a tie).

23. If players contend for position along the free-throw lanes, the referee shall (*a.* toss coin for positions; *b.* arrange players to their own desires; *c.* arrange players so that desirable positions are divided; *d.* call technical foul on both teams for disputing; *e.* ignore it).

24. On an out-of-bounds play the ball can be held (*a.* one second; *b.* five seconds; *c.* three seconds; *d.* indefinitely; *e.* as long a time as the referee feels is necessary).

25. When the game is started without the use of the center toss, the referee throws the ball to (*a.* the center forward of the team winning the last point; *b.* the center forward of the team losing the last point; *c.* alternate center forwards; *d.* same center forward for one quarter, alternating teams thereafter; *e.* same center forward for half, other team for second half).

26. The penalty for batting or snatching the ball from the hands of a guard is (*a.* an unguarded throw for the player who had the ball; *b.* guarded throw out-of-bounds for the player who has the ball; *c.* two free throws; *d.* one free throw; *e.* toss up).

27. Pushing an opponent who has the ball is called (*a.* overguarding the ball; *b.* overguarding an opponent; *c.* charging; *d.* obstruction; *e.* pushing).

28. A player who has left the game for reasons other than disqualification may re-enter the game (*a.* not at all; *b.* once; *c.* twice; *d.* once providing opposing team is willing; *e.* any number of times providing the opposing team is willing).

29. A pivot is a play in which the player (*a.* takes two steps in any direction with alternate feet; *b.* takes one complete step in any direction; *c.* steps once or more than once in any direction with the same foot, the other foot keeping point of contact with the floor; *d.* bounces the ball and then takes one step; *e.* juggles the ball and then takes one step).

30. Obstruction is (*a.* pushing a person while running with the ball; *b.* guarding a person without personal contact; *c.* impeding the progress of a player who does not have the ball; *d.* impeding by personal contact the progress of a player who has started to advance the ball by means of a bounce, juggle, or pivot; *e.* standing in front of a player who does not have the ball).

31. The penalty for throwing a ball when not standing on one or both feet is (*a.* a free throw; *b.* an unguarded throw where committed; *c.* a guarded throw out-of-bounds at side lines; *d.* a guarded throw out-of-bounds at end lines; *e.* a toss up).

32. In making a free throw a player should not consume more than (*a.* five seconds; *b.* ten seconds; *c.* three seconds; *d.* eight seconds; *e.* fifteen seconds).

33. An out-of-bounds throw at the side line is given when a player (*a.* guards an opponent already guarded; *b.* guards around a player; *c.* sends the ball over the end line; *d.* uses an illegal bounce; *e.* holds a player).

34. The penalty for any violation is (*a.* free throw for goal; *b.* an unguarded throw on the spot where the violation occurred; *c.* an unguarded throw out-of-

bounds at the side lines; *d*. a guarded throw from out-of-bounds at the side lines; *e*. a guarded throw taken out-of-bounds at side or end lines).

35. A disqualifying foul is (*a*. usually a technical foul; *b*. rough play for which a player is removed from the game; *c*. anything which causes a player to be removed from the game; *d*. a foul called by both the referee and the umpire; *e*. a foul usually not involving personal contact).

36. Red forward in making a free throw for basket steps over the line and the basket is made. The decision is (*a*. the goal counts, but the ball is given to a guard out-of-bounds; *b*. the goal does not count and the ball goes back to center; *c*. the goal does not count and the ball is given to a guard out-of-bounds at the side line; *d*. the goal does not count and a jump ball is taken ten feet from the basket; *e*. the goal does not count and the guard takes ball out-of-bounds at end line).

37. At the center jump the player jumping may (*a*. catch the ball after hitting it; *b*. tap the ball more than once; *c*. hit the ball as it is being tossed up; *d*. step out of the circle as she taps the ball; *e*. tap the ball twice and then catch it).

38. The situation which determines the awarding of one or two free throws is whether or not (*a*. the basket is made in spite of the fact that the forward, while in the act of shooting for basket, is fouled by a guard; *b*. a guard committed a personal or technical foul on a forward who is in the act of shooting for basket; *c*. the guard intentionally fouled a forward in the act of shooting for basket; *d*. the person fouling committed two fouls simultaneously; *e*. a double foul occurs while the forward is shooting for the basket).

39. When the game is started with the center throw, the forward who is to take the throw may (*a*. stand with one foot in the circle, and one foot out; *b*. use any kind of pass; *c*. pivot and move one foot outside the circle; *d*. hold the ball ten seconds after the referee's whistle; *e*. bounce the ball to herself).

40. Of the following, the best pass for long distance is (*a*. chest pass; *b*. two hand overhead pass; *c*. bounce pass; *d*. under arm pass; *e*. over arm pass).

41. The score of a forfeited game or a game won by default is (*a*. 2-0; *b*. 0-0; *c*. 1-0; *d*. 5-0; *e*. 2-1).

42. A legal juggle is one in which the ball (*a*. is thrown up not higher than the shoulder and is caught before it touches the floor; *b*. is thrown or batted up above the head and allowed to bounce before it is caught; *c*. is thrown or batted so that the bottom of the ball goes above the head and is allowed to bounce twice before being caught; *d*. is thrown up regardless of height; *e*. is thrown above the head and caught before it touches the floor).

43. Continually dancing or standing with arms outstretched in front of a player not in possession of the ball is called (*a*. charging; *b*. tagging; *c*. obstruction; *d*. traveling; *e*. blocking).

44. Of the following combinations of fouls, the one which contains more than two technical fouls is (*a*. pushing, holding, blocking, guarding an opponent already guarded; *b*. pushing, touching ball held by opponent not throwing for basket, snatching ball from opponent, guarding an opponent already guarded; *c*. obstructing, holding, guarding with contact, tripping; *d*. obstructing, pushing, holding, guarding with contact; *e*. holding, guarding with contact, guarding an opponent already guarded, blocking).

45. Red forward is making a free throw; the blue guard steps into the lane before the throw is completed. The basket is not made, and the ball is caught by a guard. The decision is (*a*. forward shoots for basket again; *b*. guard gets a throw out-of-bounds at side; *c*. forward gets a throw out-of-bounds at end; *d*. red team gets a point; *e*. forward gets a throw out-of-bounds at the side lines).

Alkali Reserve of the Blood in Relation to Swimming Performance

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THERE has always been a baffling mystery as to why at certain times individual athletes fail to perform up to their apparent standard of ability. Since all muscular activity is concerned with chemical reactions, certainly the field of chemistry should be able to throw some light on these fluctuations.

The physical education field has been much concerned with tone and physical growth of muscle; however, little thought and consideration have been given to blood chemistry in relation to exercise. The chemical composition of the blood has many vital relations to muscular contraction and relaxation; e.g., calcium contracts muscle cells and potassium relaxes them.

One of the most important chemical considerations is the acid-base balance of the blood. While the blood is always alkaline, there is a wide fluctuation in the quantitative amount of what is termed the "alkali reserve." A depleted alkali reserve is inappropriately called a condition of "acidosis," which might imply that the blood is really acid in reaction. The blood never becomes acid because the human organism is equipped with an efficient buffer system that prevents this condition from taking place. This vital mechanism is provided to maintain life. Though life may be preserved on a low alkali intake, the human organism may fall far short of muscular efficiency.

This paper deals with the study of the alkaline reserve in relation to athletic performance in swimming. The study was conducted with the members of the swimming team at Oregon State College during the 1934–1935 term. The object was to try to determine the influence that the alkali reserve of the blood might have on the speed and endurance of swimmers.

Any study of the muscular efficiency of the human machine must necessarily consider the chemical changes involved. During exercise, one product of the muscle cell is CO_2 usually referred to as carbonic acid. As this weak acid enters the blood to be transported to the lungs for elimination, it is balanced with weak base (B HCO_3) or buffered in order to maintain approximate blood neutrality. This relation is best

expressed by Henderson*[1] by the fraction $\frac{H_2\ CO_3}{B\ HCO_3}$. Increasing the numerator of this fraction tends toward acidosis, or a depleted alkali reserve, while increasing the denominator tends toward alkalosis or an excessive amount of alkali in the body fluids. Increasing the numerator and decreasing the denominator amounts to the same thing—tendency to acidosis. The numerator may be increased by severe muscular exercise without the compensating elimination of the CO_2 manufactured, or by inhaling air high in CO_2. The denominator may be decreased by the acids coming in by way of the food carrying away the bases, or by excessive quantities of lactic acid formed from muscular action, or by excessive fatty acids when much fat is being metabolized as in diabetes.

It is apparent that the amount of base "*B*" of the B HCO_3 per unit of blood is an important factor in the efficiency of the human machine. The many reactions involved may be summarized in the statement, that if "*B*" is increased to a physiological maximum, it would appear logical that the chemico-physical mechanism controlling respiration would be pushed up to a higher level of efficiency in eliminating CO_2 and the onset of fatigue be delayed. Now "*B*" of the B HCO_3 (Henderson fraction) is mainly sodium and potassium with small amounts of calcium and magnesium, and fortified in extreme emergencies by ammonium from the proteins. The amount of "*B*" is referred to in chemical literature as "alkali reserve of the blood." When "*B*" is low all the buffer mechanisms of the blood are called into play to keep the hydrogen-ion concentration of the blood down, or in other words to keep the blood and body fluids from actually becoming acid. "Acidosis" is a medical term which really means a condition of depleted alkali reserve rather than an actual acid condition of body fluids. Body fluids rarely become acid, but the range of blood reaction compatible with life is from pH 7.0 to 7.8, or on the alkaline side of neutrality. The blood becomes not acid but less alkaline.

Lactic acid is a normal product of the muscle cell during exercise. It is termed "sarco-lactic acid." Fletcher and Hopkins[2] and later Hill and Long[3] found that with the contraction and relaxation of a muscle, one-fifth of the muscle glycogen was converted to lactic acid. Normally, lactic acid is oxidized in the metabolism to CO_2 and H_2O. In severe exercise, the excess passes into the blood and must be neutralized by a base. In a swimming race for instance, the "*B*" of the denominator of the Henderson fraction is being rapidly reduced to neutralize the flood of lactic acid. According to Long[4] venous blood contains normally about 10–20 milligrams of lactic acid, but during moderate exercise this is increased to 50–60 mgs. per 100 cc. of blood. In severe exercise Jervell[5] found the lactic acid in blood as high as 130 mgs. per 100 cc.

* Numbers refer to bibliography at the end of the article.

Jervell was only able to recover approximately 1 per cent of the lactic acid (produced by muscular exercise) from the urine, showing that very little of the excess is eliminated by the kidneys. Aside from the amount excreted in sweat, lactic acid must for the most part be neutralized at the expense of the alkali reserve of the blood. The sour lactic acid odor of the athletes' sweat shirts is evidence that lactic acid is excreted in the sweat. Snapper and Grunbaum[6] suggested that the excretion of lactic acid in perspiration might explain in part the mystery of "second wind." While their observations have been questioned for lack of sufficient data, their argument was logical in that excreted lactic acid releases bases for the formation of bicarbonates and the building up of the denominator of Henderson's fraction. The opinion has long been entertained that the accumulation of lactic acid brings on fatigue. Medical men refer to the acidosis from this cause as a "sarcolaxis."

Two acids are thus seen to spring from the muscle cell during exercise, carbonic and lactic. While the blood may be equipped with ample buffer substances to balance these acids in moderate and continuous exercise, in severe exercise such as a swimming race, the buffers are apt to be deficient. Since it is becoming well known that the amount of buffer substances in the blood is important, various food devices are being used to build up the alkali reserve of the blood. Fruits, tomato juice, and orange juice are used. Tomato juice and orange juice contain mainly the citrates and tartrates of potassium, and are relatively low in sodium. Blood plasma on the other hand is high in sodium and low in potassium. Certain so-called "alkalizers," mainly alkaline salts of citric and tartaric acid are being used. In all these, the alkali reserve is being built up by the fact that while the organic part (citrates, tartrates, etc.) is broken down in metabolism, the bases remain.

For the purpose of our experiment with swimmers, we used tomato juice, a diluted commercial orange juice, and a concentrated alkalizer that seemed to contain the bases in the approximate ratio of blood. The commercial orange juice was found to contain only 3.2 milliequivalents or units of total base per 100 cc., the tomato juice contained 5.3 units, and the concentrated alkalizer 16.0 units per 5-gram dose.

As a rough measure of the condition of alkali reserve before and after the race, the only clinical test that seemed practical was Folin's titration of the urine. The CO_2 combining power of the blood and the CO_2 tension of the alveolar air, while being more accurate, were not available for quick approximate results.

For the urine test, samples were collected from swimmers before and after the swim. The Folin titration measures the total acid excreted in 25 cc. urine in terms of N/10 base, and in the same sample the amount of ammonium salts [NH_4CL, $(NH_4)_2\ SO_4$, etc.]. It is customary to report the test as total acid plus ammonium salts in terms of

ccs. of N/10 base used. Phenolphthalein indicator is used for the titrations. First the urine is treated with 5 cc. of neutral potassium oxalate solution to throw out the calcium salts. After the acid titration, 40 cc. of neutral 10 per cent formalin is added, which liberates acids equal to the ammonium salts. In terms of ccs. of N/10 base required for total acid plus ammonium salts per day per kgm. body weight, this test correlates very well with the more accurate methods of estimating the alkali reserve of the blood.[7] The range of urine tests by this method was from 0 to 50 cc. N/10 base per 25 cc. urine.

It was observed that the increase in ammonium salts in the urine was greater in the middle-distance races than in the shorter or longer races. It was believed that the pace in the distance races, such as the 440-yard swim or longer, is not too fast for the blood to maintain an equilibrium in the acid-base balance, but in the middle and sprint distances the alkaline buffers are reduced to a low level.

It was also observed that the specific gravity of the urine of athletes finishing a swimming race was just opposite to that of other severe activities in that the urine was more dilute and the specific gravity was lowered after the race rather than raised. The average specific gravity of urine before races was 1.022 and after races 1.015. It was inferred that there was little sweating during the swim.

In all cases where athletes were recovering from colds or influenza, their urine tests were high (30 cc. or more N/10 base for total acid plus ammonium salts in 25 cc. urine). It was likewise noted that swimmers in this condition were not able to make their normal time in a race. Hence it was inferred that such athletes were manifesting a rather severe acidosis.

After alkaline treatment, the swimmer's urine test had always a lower acidity when he entered the race, and there seems to be a definite positive correlation between the lower test and the lowered time of the swimmer. This is an agreement with observations of Taylor and Howe[8] that alkali reserve by CO_2 tension correlates + 0.69 with the Schneider test.

THE TEST

Before the tests were started the swimmers were put through a rigorous three-month training and conditioning period. By this it was hoped that many of the early season fluctuations that ordinarily take place during athletic conditioning might be eliminated from the test results. Eleven cases were used throughout the test, but only six were charted and tabulated. The other five were eliminated from the final analysis because of their inability to complete all the tests.

Five tests for each individual without alkaline treatment were scattered throughout the entire period to determine what the normal swimming curve of each swimmer would be. On the charts this was plotted

as N. T. (no treatment) and is labeled as the training curve. Five alkaline treatments were given—the first two a commercial alkalizer, the third orange juice, and the last tomato juice. To test the psychological effect that these alkalizers might have on performance, a blind treatment was given. The next to the last test was an attempted acid diet followed by the regular no-alkaline treatment.

Each individual swam in two races except the distance men. The events as used were the 150- and 100-yard backstroke, 200- and 100-yard breaststroke, and the 440-yard free style. Charts were made on first swims only. Race conditions were used because there were two individuals in each event and as the men were fairly equal in ability it was felt the results would be far more representative of the individual's maximum ability at any one time. To make the tests as objective as possible, the stop-watch method was used. Results were tabulated in fifths of seconds. (See charts—cases 1 to 6 inclusive.)

Outside factors which are known to be significant and to influence performance were noted and controlled whenever possible. In order that the increase or decrease of ability due to the alkaline treatments might be reliably determined the physical and mental state of each individual was ascertained before each swim. It was found that when individuals lost sleep their performance decreased. Likewise when they had colds a decided lessening of ability was shown. In order that these factors might not color the results without a possible explanation, the physical condition of each individual was checked before the swim and marked as good, fair, or poor. In the last two categories the individual was asked to give his possible reason for not feeling up to par. Some of the typical reasons were lack of sleep, colds, irregular eating, and constipation.

In order to test whether the alkalizers had any psychological effect on increasing performance, a blind treatment was given. The material tasted similarly to the commercial alkalizer, but it made no alkaline or acid contribution to the blood. Strangely enough only one individual made any positive response by improvement in time. (See chart case II.) From personal observation and experience this individual would be classed as the emotional type and easily influenced by suggestion.

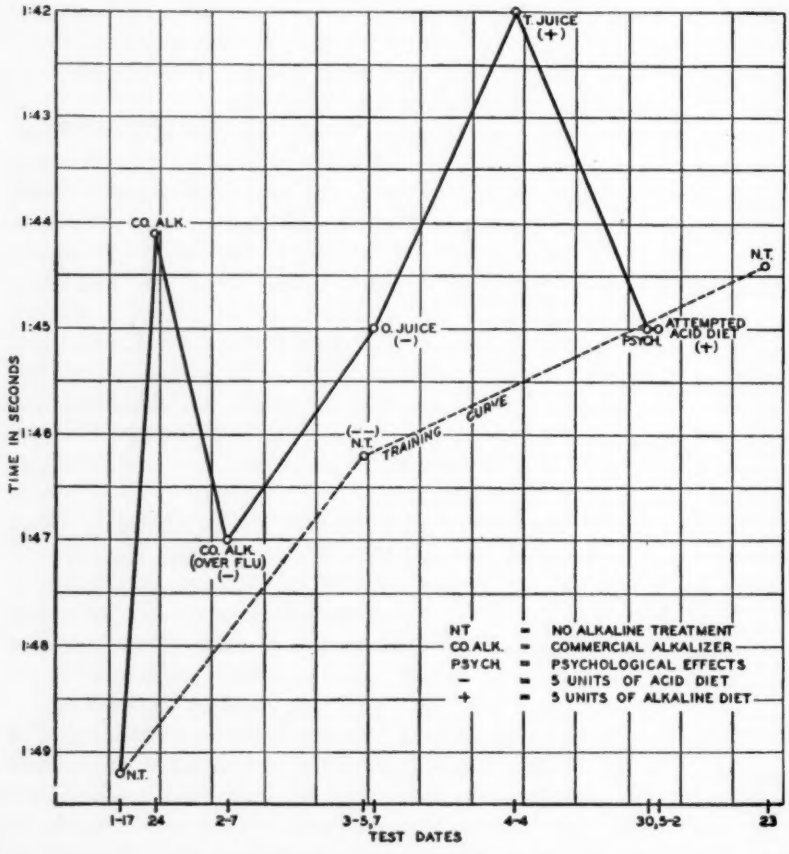
An additional factor which is highly significant and which must be considered is that of diet. Before each test each individual wrote down his diet for the past three meals—dinner, breakfast, and lunch. As the boys were greatly interested in the experiment they showed remarkable cooperation by keeping a very accurate account of their diets. These diets were tabulated according to an average individual helping and figured according to Bradley's Table of Food Values.[9] This is at present the best rough evaluation of foods known; although not highly accurate, it serves the purpose as a rough measure in showing whether the

average meal was acid or alkaline. Where the diet appeared significant, it is indicated on the charts. Food reaction units on the alkaline and acid side were translated from points into a plus (+) for each five units of alkaline and minus (—) for each five units of acid.

CASE I
SWIM A

THE EFFECT ON SWIMMING PERFORMANCE
WITH AND WITHOUT ALKALINE TREATMENT

150 YARD BACK STROKE
(FORMER PACIFIC NORTHWEST BACK STROKE CHAMPION)

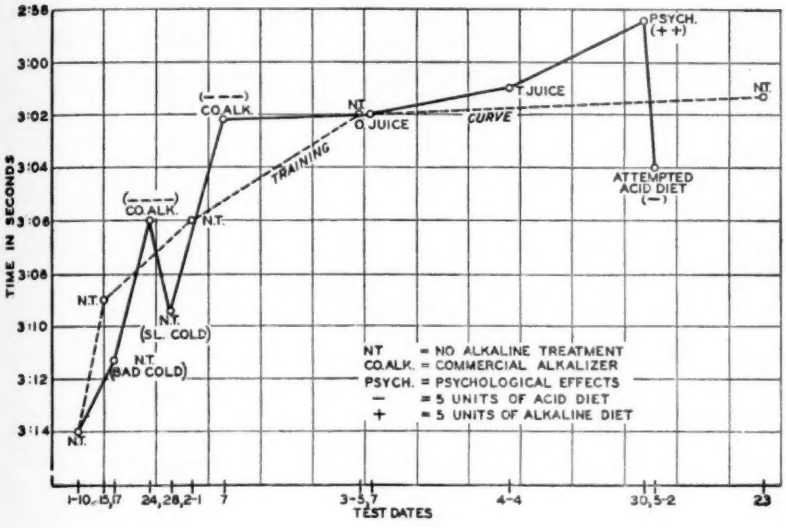


The commercial alkalizer used showed in all but one instance positive improvement of performance. The average improvement per individual was 3.95 seconds. (See composite average chart page 92.) The orange juice showed an average increase of performance per individual by 2.70 seconds. The tomato juice showed a positive average improve-

CASE II
SWIM "A"

THE EFFECT ON SWIMMING PERFORMANCE WITH AND WITHOUT ALKALINE TREATMENT

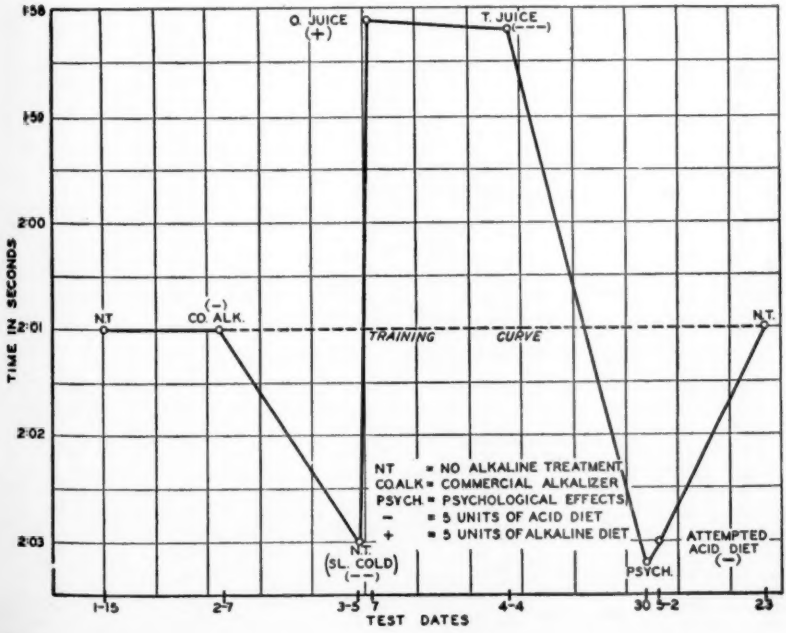
200 YARD BREAST STROKE



CASE III
SWIM "A"

THE EFFECT ON SWIMMING PERFORMANCE WITH AND WITHOUT ALKALINE TREATMENT

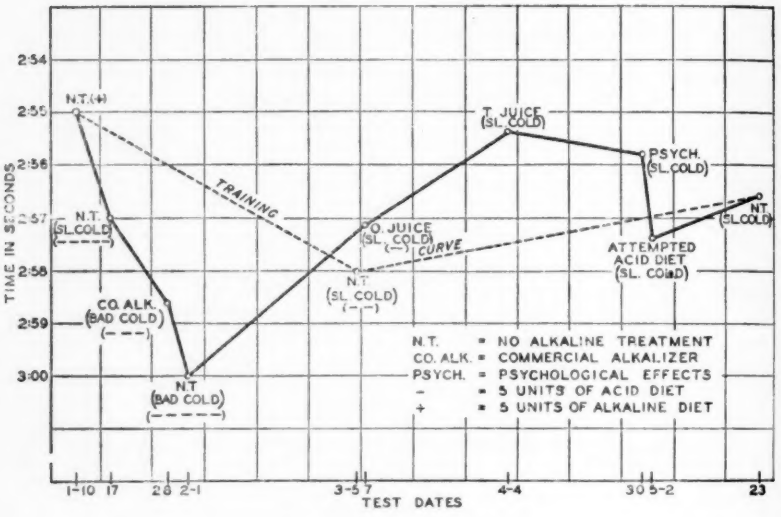
150 YARD BACK STROKE



CASE IV

THE EFFECT ON SWIMMING PERFORMANCE
WITH AND WITHOUT ALKALINE TREATMENT

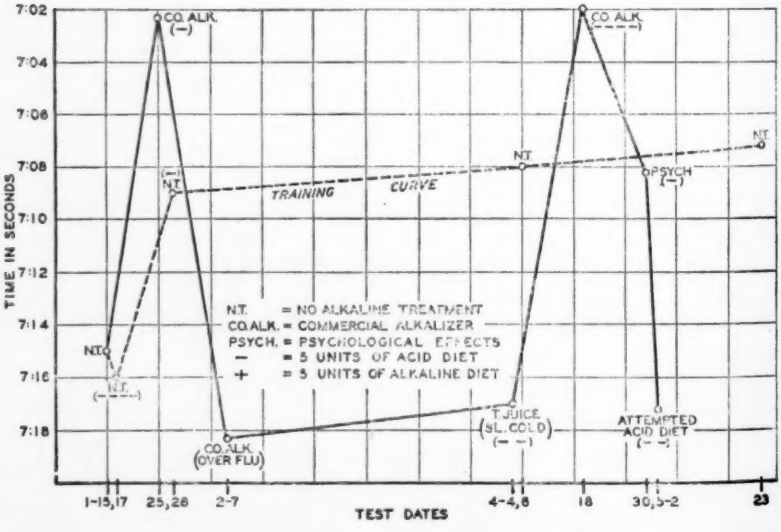
200 YARD BREAST STROKE.



CASE V

THE EFFECT ON SWIMMING PERFORMANCE
WITH AND WITHOUT ALKALINE TREATMENT

440 YARD DASH

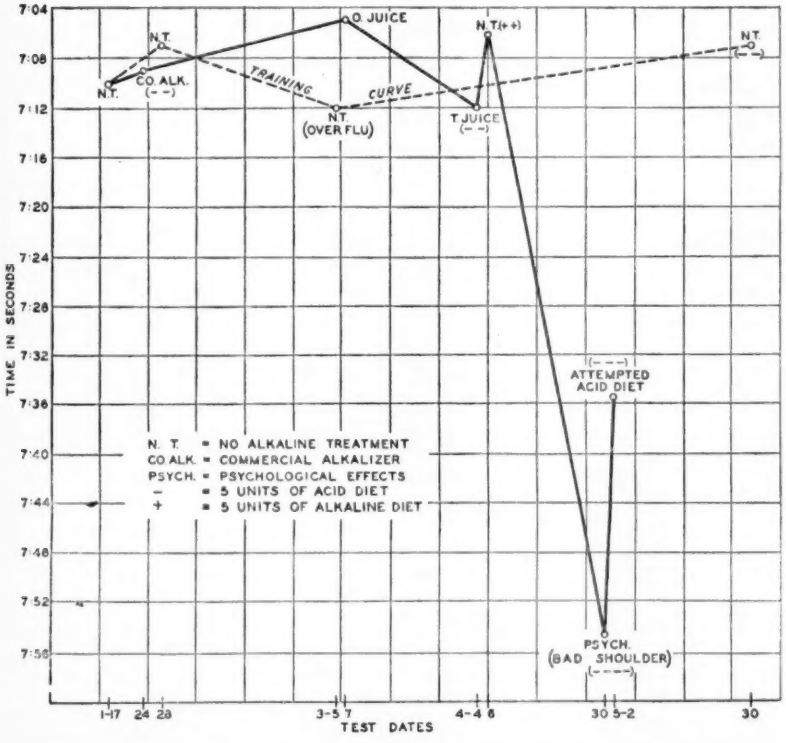


ment of 1.75 seconds per individual. An attempted acid diet was tried on all subjects, but only four of the six showed acid diet as per Bradley's tables. The three meals prior to the swim were supposed to be largely acid, but it was impossible for all of the boys to obtain this in

CASE VI

THE EFFECT ON SWIMMING PERFORMANCE
WITH AND WITHOUT ALKALINE TREATMENT

440 YARD DASH

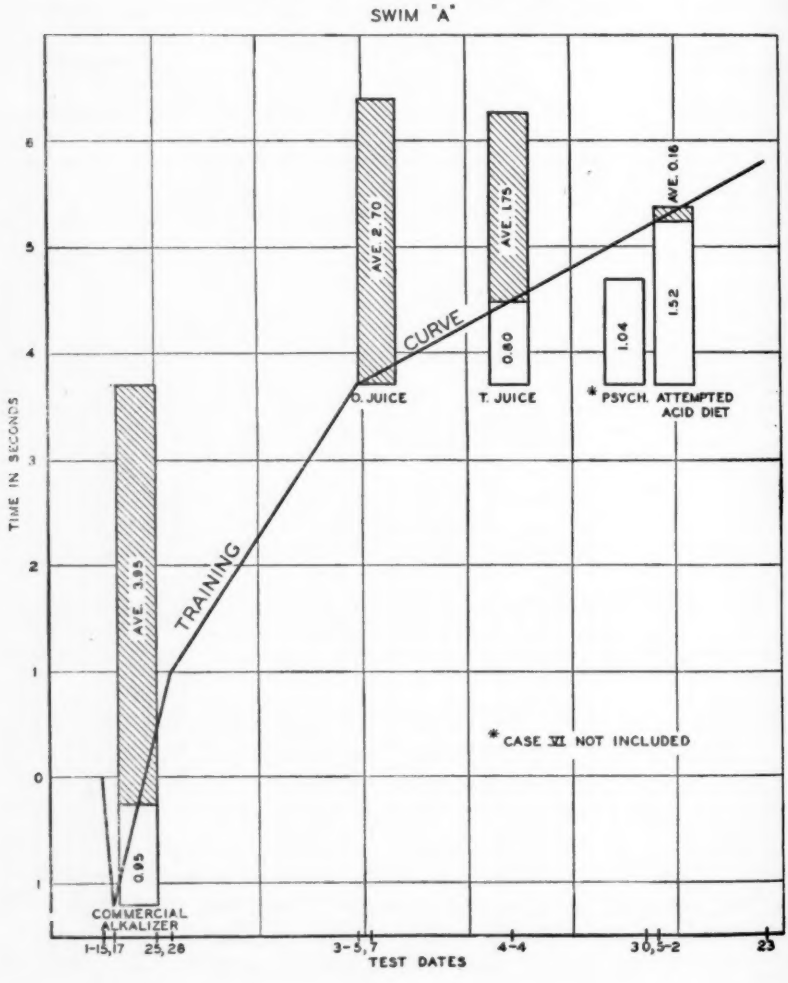


their fraternity houses. Four cases which were acid in diet showed lessened results in performance. (See charts cases II, III, V, and VI.) Acid foods seem to have significant effects on reducing the swimming ability. When the blind treatment was given to test the psychological effects of alkalizers, the results were negative in cases I, III, V, and VI. The fact that the swimmers were never told what they were taking and what their times were from swim to swim seems to substantiate the fact that the alkalizers did not appear to be psychologically helpful.

Due to the fact that there were a limited number of cases to work

with, we realize that no far-reaching and final conclusions can be made. Such conclusions will be more complete only after additional cases are worked out. However, it is hoped that this paper will awaken and stimulate those chemically-physically minded individuals to carry onward this relatively unexplored field and thus help solve many of our existing problems.

COMPOSITE AVERAGES OF INCREASE OR DECREASE IN SWIMMING PERFORMANCE WITH AND WITHOUT ALKALINE TREATMENT



CONCLUSIONS

1. Alkaline treatment, such as administration of organic salts of bases in foods or in concentrated form, appears to improve swimming performance.

2. Habitual acid diet, colds, and other ills, where "acidosis" is a symptom, seem to reduce the efficiency in swimming performance.

3. Apparently swimmers perspire very little in comparison with other types of athletics, hence it is presumed that there can be very little elimination of lactic acid through the skin.

4. Titration of the urine before and after swims seemingly indicates that severe physical exercise rapidly depletes the alkaline reserve of the blood.

5. The training curve must be constantly considered in its relation to improvement before the effects from other factors can be determined.

6. Diet remains an undetermined but significant factor unless weights of alkaline and acid foods are recorded. Acid diet appears to lower the efficiency of athletic performance.

7. Apparently the "psychological drive" originating in the idea that the swimmer has taken an "alkaline boost" is not positively significant.

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A Study of the College Women's Physical Education Department in its Relationship to the Community's Adult Leisure-Time Activities

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INCREASED leisure time has made a direct challenge to the physical education profession. Members of the profession are meeting the challenge in their work with students from the elementary grades through college by accepting as one objective of their program the preparation for leisure-time activities and by definitely establishing within their program activities which promote the formation of habits, skills, knowledge, and attitudes favorable to the wise use of leisure time.

Within a relatively short time the question has arisen whether the responsibility of the college physical education department for leisure-time provision and training stops with the college student or whether it should extend to others in the community. To determine how generally college physical education departments for women have felt the need to contribute to the community work and what procedures they are using in accepting any responsibility for adult leisure-time activities, a questionnaire was sent to all the state universities, to a few other outstanding universities, and to fifty teacher-training institutions. Replies were received from thirty-three universities and thirty-nine teachers' colleges, making a total of seventy-two institutions, representing thirty-one states distributed generally over the country.

THE results of this questionnaire are given in an effort to determine the possible responsibility of the college physical education department to promote the community's adult leisure-time activities.

Of the thirty-three universities, twenty-seven, or 81.8 per cent, are giving some form of an adult leisure-time program; six, or 18.1 per cent, are not offering such a program. Of the thirty-nine teachers' colleges, eighteen, or 46.1 per cent, are giving some form of a leisure-time program and twenty-one, or 53.8 per cent, are not offering such a program. Considering both types of institutions, it is found that 62.5 per cent are providing a leisure-time program for the community and 37.5 per cent are not.

There seems to be little correlation between the size of the town or city in which the institution is located and the extent to which the institution provides an adult leisure-time program for the community.

The population of the towns in which those universities offering such a program are located ranges from 2,100 to 450,000 with the median at 20,000. For teachers' colleges the range is 700 to 36,000 with the median at 8,000. The range of population of the towns in which institutions are located which do not offer leisure-time programs is 12,000 to 3,000,000 for the universities with the median at 27,500; and 500 to 506,000 for the teachers' colleges with the median at 18,000.

Neither does there seem to be a definite correlation between the number of instructors in a department and the department's provision for an adult leisure-time program. The range of instructors in universities with an established community program is one to eleven with the median at five; for teachers' colleges one to seven with the median at three. The range of the number of instructors in the institutions not offering such a program is two to twenty-five for the universities with the median at four; for the teachers' colleges one to nine with the median at three.

The type of service which departments are offering in promoting an adult leisure-time program and the community groups for which the program is offered differs with the various institutions. Twenty-one universities offer class activities with instruction. Of this number one opens the class to faculty women only; twelve to faculty women, wives of faculty men, and office force, a group I, hereafter, shall refer to as the faculty group; five to alumnae and special groups, such as the A.A.U.W.; and eleven to any woman of the community. Twelve teachers' colleges offer class activities with instruction. Three open the class to faculty women only, three to the faculty group, one to alumnae, and ten to any woman of the community. In most cases the activities are presented in classes provided especially for these particular groups. Four institutions permit the adults to enter regular college classes as non-students, and two institutions offer their leisure-time program by means of extension classes.

The physical education departments for women in fifteen universities offer the use of their equipment in contributing to the community program. Two of these give this privilege to faculty women only, eight to the faculty group, and three to any woman in the community. Thirteen teachers' college departments offer the use of their equipment to community groups. Three of these give this privilege to the faculty group, and ten to any woman in the community.

Fourteen universities and six teachers' colleges report that instructors of the physical education department serve as recreational leaders in the community, directing games and social events. Seven university departments report that their instructors assist in athletic contests for the community, four in the capacity of organizers, four as officials, and one in both capacities. Seven teachers' college departments report that their instructors take charge of community athletic contests, four as organizers, six as officials, and three in both capacities.

THE popularity of various activities in the physical education program for leisure-time activities can be noted from the number of times departments report offering them for class instruction. The activities take the following rank from university reports:

1. Swimming
2. Natural dancing
3. Tap dancing
4. Gymnasium classes
5. Folk dancing
   Basketball
6. Clog dancing
   Social dancing
   Golf
   Tennis
7. Archery
   Badminton
   Volleyball
8. Horseback riding
9. Ice skating
   Correctives
10. Baseball
    Field hockey
    Bowling
    Ping-pong

The activities take the following rank in popularity at the teachers' colleges:

1. Swimming
2. Basketball
3. Social dancing
   Volleyball
4. Clog dancing
   Folk dancing
   Tap dancing
   Archery
   Baseball
   Golf
   Tennis
   Gymnasium classes
   Roller skating
   Horseback riding

Note that the teachers' colleges report no classes in natural dancing for community groups while this activity ranks second for the universities.

An idea of the type of activity participated in by leisure-time adult groups again is gained by noting the equipment used when no class instruction is given. The report of the University departments rank the use of equipment in the following order:

1. Swimming pool
2. Gymnasium
3. Badminton courts
4. Tennis courts
5. Basketball courts
   Ping-pong tables
6. Archery
   Golf links
   Volleyball courts
7. Horses
8. Baseball diamond
   Roller-skating equipment
   Tetherball
   Shuffle board
   Bowling alleys
   Duckpin bowls

The teachers' college departments' reports give the following rank:

1. Tennis courts
2. Swimming pool
3. Gymnasium
4. Basketball courts
5. Volleyball courts
6. Golf links
7. Badminton courts
   Ice-skating rink

IN MOST institutions the community class for adult leisure-time activities is scheduled once a week. The second most common practice is to schedule the class twice a week. A 60-minute class period is held by the majority of universities and a 40-minute period by the teachers' colleges. The range of class periods is from 30 to 180 minutes.

Some community classes are being conducted with a membership as

small as from five to nine individuals and as large as from sixty to sixty-four individuals in the universities and ninety in the teachers' colleges.

The question, "How many instructors in the women's physical education department teach classes for members of the community?" brought the following replies: Four universities and five teachers' colleges have one instructor scheduled; seven universities and four teachers' colleges, two instructors; three universities, three instructors; two, four; and one, five instructors. One class for each instructor is most common.

Four universities and six teachers' colleges report that one instructor from the physical education department is on duty but not instructing the leisure-time group. Two universities report two instructors; one teachers' college, three; and one university, five instructors. The common practice is to schedule each instructor for two hours a week for this work.

If college physical education departments undertake adult classes for leisure-time activities, what is the relation of the class to the instructor's schedule? This is a vital question to instructors and administrators alike. Sixteen universities and seven teachers' colleges have the arrangement that the community class is in addition to the regular teaching load of college classes which the instructor carries in the department. Six universities and four teachers' colleges have arranged to lessen the number of college classes for the instructor in order to include the community class as part of the regular teaching load of the instructor.

In eight universities and five teachers' colleges the instructor is assigned the community class by the director. In twelve universities and five teachers' colleges the instructor is given the privilege of making a decision in regard to taking the class.

THE results of the questionnaire reveal the fact that there is no standardization of fees which are charged adults for membership in the community leisure-time activities. In fact, there are so many different fee arrangements it is possible to treat the subject only by citing a few institutions as typical examples.

The University of Colorado charges a fee of $1.50 a quarter which entitles the class member to a locker, swimming suit, and towel service. The Women's College, University of Delaware, gives the community class as an extension course and charges a fee of $6.50 per credit hour for fifteen hours of 120 minutes. The University of Georgia has a fee of $3.00 for sixteen lessons for the class offered to the faculty group. The University of Illinois has a $2.00 locker fee, a $0.50 towel fee which is refunded, and a $4.50 suit and instruction fee. The University of North Dakota charges $4.00 for ten lessons in swimming, $2.00 for six tap-dancing lessons, $1.00 for six social dancing lessons. The University of Texas charges $3.00 for one course or $5.00 for two courses which consist of thirty lessons. The fee includes instruction, locker,

towel and suit, and attendant service. The lowest fee is charged by the University of Minnesota. Members of the class pay $1.00 a quarter for a class which meets once a week. The Universities of Cincinnati and Utah have the highest fees, charging $10.00 for thirty lessons.

The Colorado State School of Education at Greeley, Colorado, charges a fee of $6.00 for a swimming class which meets twice a week. The State Teachers' College at Frederick, Virginia, charges $10.00 for thirty-six lessons.

Questions concerning the financial arrangements for the instructors' time revealed some significant findings. In nine universities and five teachers' colleges the instructor has donated her services for community work. In ten universities and four teachers' colleges the instructor receives no extra salary because the class is included in the regular teaching load for the instructor. In seven universities and one teachers' college the instructor receives payment for services from the fees paid by members of the class. And two universities report that the instructor is paid an additional salary by the institution for taking the class.

The question was asked as to the administrative provision for the expenses of the community adult leisure-time classes. In ten universities and one teachers' college the expense is charged to the women's physical education department; in one teachers' college to the physical education department, which includes both the men's and women's divisions; in six universities and five teachers' colleges to the administration; and in two universities to the extension department. The University of Texas reports a self-sustaining account for the community work which is headed, "Adult Night Classes, Physical Training for Women." The University of Washington also reports a self-supporting plan. In two teachers' colleges the expense is handled through the F.E.R.A.

AND now what do the departments say which do not have a program of leisure-time activities for the community or which have found it advisable to do very little community work?

The University of Nebraska writes: "Lincoln has a Community Recreation Department which adequately takes care of the problem with no need for help from the University." This situation is true also for the University of West Virginia and the teachers' colleges at Santa Barbara, Kalamazoo, Milwaukee, and Memphis.

The Hattiesburg, Mississippi, State Teachers' College reports that the Y.M.C.A. and the Y.W.C.A. are taking care of the recreation needs. The La Crosse State Teachers' College makes a similar comment.

A. W. Hobt from the University of Tennessee writes: "A municipal school would be more interested in community recreation than a state school. Work of a state school should be state-wide in character."

The University of Nevada says inadequate facilities at present prevent a community program but there are hopes to establish a program

in the future. The teachers' colleges at Terre Haute, Indiana, Farmington, Maine, and Providence, Rhode Island, report that their gymnasia are used to full capacity by college students.

The Universities of Arkansas and Ohio report that the size of the staff in the physical education department prevents the desired program for the community.

A lack of interest in activity classes by the women of the community is reported by the teachers' colleges at DeKalb, Illinois, Richmond, Kentucky, and Athens, West Virginia.

AS A summary of the questionnaire findings the following points are given as significant.

The college physical education departments for women which have felt a need to promote a community leisure-time program are distributed generally throughout the United States. Again, the departments which are not offering a program are as generally distributed. Likewise the size of the city in which the departments are offering or not offering, a program varies from small to large communities. It seems that the geographical location of the institution is not a deciding factor in the question of the departments offering a leisure-time program for the community. Again, the number of instructors in the department is not always the determining element. In many instances departments with few staff members have made noble efforts to contribute to the community's needs.

At the present time physical education departments for women in the universities are sponsoring a community program to a greater extent than those in teachers' colleges. On the other hand, the teachers' college departments show a greater tendency to open their classes and offer their equipment to any woman in the community.

The survey has shown a variance of procedures taken by the institutions to carry on a program. In this connection the following questions arise as problems to be faced by college physical education departments in the future in undertaking to contribute to the adult leisure-time activity program of the community:

1. Should such classes be conducted as extension courses?
2. Should women of the community be urged to join college student classes or are there disadvantages in such an arrangement?
3. Should the women's physical education department open classes to a mixed group of men and women?
4. Should instructors of a physical education department be asked to take a community class in addition to a regular teaching load?
5. Should instructors be asked to donate services for such classes?

In light of the above facts, the following conclusion is drawn:

In communities with well-organized municipal agencies there is less need for the college to promote a community leisure-time program. In communities lacking these facilities there is a more distinct place for the college physical education department to assume a responsibility.

TABLE I

MASTER CHART SHOWING PRACTICES IN PHYSICAL EDUCATION DEPARTMENTS FOR WOMEN IN UNIVERSITIES IN CONTRIBUTING TO THE COMMUNITY'S ADULT LEISURE-TIME ACTIVITIES

University	College Enrollment	Population of Town	Number of Instructors in Physical Education Department for Women	No Leisure-Time Activities for Community Sponsored by Department	Services of Department for Community Leisure-Time Activities						Community Groups for Which Dept. Sponsors Classes			Community Group Permitted to Use Department's Equipment		
					Class Activities with Instruction	Non-Students Admitted to College Classes	Leisure-Time Activities Offered as Extension Course	Use of Department's Equipment by Community Groups	Services of Instructors for Conduct of Athletic Contests	Services of Instructors as Recreational Leaders	Faculty Members	Faculty Members, Wives and Husbands of Faculty Members, Secretaries, etc.	Any Woman in the Community	Faculty Members	Faculty Members, Wives and Husbands of Faculty Members, Secretaries, etc.	Any Woman in the Community
Alabama	4,000	26,000	2			√										
Arkansas		10,000	2					√							√	
Colorado	3,212	11,227	5		√							√				
Delaware Women's College	300	4,500			√		√				√					
Georgia	2,500	20,000	6		√							√				
Illinois		35,000	9		√			√		√		√			√	
Indiana	4,000	20,000	6		√		√						√			
Purdue	5,000	22,000	3		√			√		√		√				
Iowa	7,000	15,000	8		√			√				√				
Louisiana State	4,000	30,000	2	√												
Maine	1,476	3,000	2					√	√					√		

Maine	1,476	3,000	2					√	√				√	
Michigan	9,005	28,000	8		√			√	√	√		√	√	√
Minnesota	21,776*	½ mil.	11		√			√	√	√		√	√	
Missouri	3,689	13,000	6		√			√		√		√	√	
Montana	1,500+	15,000	1					√		√			√	
Nebraska	5,800	85,000	6	√										
Nevada		12,000		√										
New Hampshire	1,700	2,100	4		√			√		√		√		√
New Mexico	1,000+	25,000	2	√										
New York	32,000	7 mil.	25	√										
North Dakota	1,615	20,000	2		√				√	√		√		
Ohio	2,500	7,500	5		√		√					√		
Ohio State	10,000	300 th.	10		√			√	√	√		√		
Cincinnati	10,000	450 th.	5		√			√				√	√	
Oklahoma	5,600	7,500	5		√			√	√	√		√		
Oregon	2,413	18,000	6		√			√		√		√	√	
Tennessee	2,400	105 th.	3						√	√				
Texas	7,035	66,000	7		√	√						√		
Utah	3,600	150 th.	3		√		√	√		√		√	√	
Washington	8,000	350 th.	9		√			√		√		√		√
West Virginia	2,700	18,000	4	√										
Wisconsin	8,000	65,000	11		√					√				
Wyoming	1,100	8,900	1		√	√						√		

* Minnesota's questionnaire says: "21,776 including collegiate body, sub-collegiate body, extension, and correspondence."

TABLE II

MASTER CHART SHOWING PRACTICES IN PHYSICAL EDUCATION DEPARTMENTS FOR WOMEN IN TEACHERS' COLLEGES IN CONTRIBUTING TO THE COMMUNITY'S ADULT LEISURE-TIME ACTIVITIES

Teachers' Colleges	College Enrollment	Population of Town	Number of Instructors in Physical Education Department for Women	No Leisure-Time Activities for Community Sponsored by Department	Services of Department for Community Leisure-Time Activities					Community Groups for Which Dept. Sponsors Classes			Community Group Permitted to Use Department's Equipment		
					Class Activities with Instruction	Non-Students Admitted to College Classes	Leisure-Time Activities Offered as Extension Course	Use of Department's Equipment by Community Groups	Services of Instructors for Conduct of Athletic Contests	Services of Instructors as Recreational Leaders	Faculty Members	Faculty Members, Wives and Husbands of Faculty Members, Secretaries, etc.	Any Woman in the Community	Faculty Members	Faculty Members, Wives and Husbands of Faculty Members, Secretaries, etc.	Any Woman in the Community
State Teachers' Col. Jacksonville, Ala.	600	3,000	1					√		√					√	
Santa Barbara St. Tea. College, Calif.	781	36,000	2		√	√			√							
Colorado St. Col. of Education, Greeley		14,000	5		√			√					√			√
Northern Ill. St. Tea. College, DeKalb	730	10,000	3	√												
Indiana St. Teachers' College, Terre Haute ...	1,200	65,000	4	√												

| | | |

TABLE II (*Continued*)

Teachers' Colleges	College Enrollment	Population of Town	Number of Instructors in Physical Education Department for Women	No Leisure-Time Activities for Community Sponsored by Department	Services of Department for Community Leisure-Time Activities						Community Groups for Which Dept. Sponsors Classes			Community Group Permitted to Use Department's Equipment		
					Class Activities with Instruction	Non-Students Admitted to College Classes	Leisure-Time Activities Offered as Extension Course	Use of Department's Equipment by Community Groups	Services of Instructors for Conduct of Athletic Contests	Services of Instructors as Recreational Leaders	Faculty Members	Faculty Members, Wives and Husbands of Faculty Members, Secretaries, etc.	Any Woman in the Community	Faculty Members	Faculty Members, Wives and Husbands of Faculty Members, Secretaries, etc.	Any Woman in the Community
So. West Mo. State Tea. College, Springfield	850	58,000	1	√												
Kearney St. Tea. Col., Kearney, Nebraska	670	8,750	1		√								√			
State Teachers' College, Keene, New Hampshire .	300	12,000	2		√			√	√	√			√			√
State Teachers' College, Montclair, New Jersey .	800	45,000	2	√												
State Teachers' College, Trenton, New Jersey ...	731		9	√												
State Teachers' College, Buffalo, New York				√												
East Carolina St. Tea. Col., Greenville, N.C. ..	1,000	12,000	1	√												

Kent State College, Kent, Ohio	1,100		3	V								
Southeastern Teachers' Col., Durant, Okla.	800	10,000	1		V					V		
East Stroudsburg State Tea. Col., Stroudsburg, Pa.	450	10,000	3	V								
State Teachers' College, Slippery Rock, Pa.	650	700	3		V		V				V	V
Rhode Island Col. of Ed., Providence, R.I. ...	500	250 th.	2	V								
Northern Normal and Ind. Sch., Aberdeen, S. Dak. .	560	16,465	3		V			V	V	V		
State Teachers' College, Memphis, Tenn.				V								
East Texas State Tea. College, Commerce	1,025	5,000	2			V			V			V
North Texas State Tea. College, Denton	9,587	9,000	7	V								
State Teachers' College, Fredericksburg, Va.	600	7,500	3		V						V	
Concord State Teachers' Col., Athens, W. Va. ..	525	500	1	V								
State Teachers' College, La Crosse, Wis.		30,000	4				V					V
State Teachers' College, Milwaukee, Wis.				V								
Glenville State Tea. Col., Glenville, W. Va. ..	375	2,000		V								

TABLE III

MASTER CHART OF ADMINISTRATIVE PROCEDURES OF PHYSICAL EDUCATION DEPARTMENTS FOR WOMEN IN UNIVERSITIES FOR CLASSES IN LEISURE-TIME ACTIVITIES OFFERED FOR MEMBERS OF THE COMMUNITY

Universities	Number of Instructors Involved in Program for Community				Relation of Community Class to Instructors' Schedule		Method of Obtaining Instructors for Community Class		Financial Arrangement with Instructor for Community Class				Financial Arrangement of Department for Community Classes				
	Number of Instructors on Duty with Community Group but not Instructing	Greatest Number of Hours per Week Instructors on Duty but not Instructing Community Group	Number of Instructors Teaching Classes for Community Group	Greatest Number of Classes per Instructor for Community Group	Community Class in Addition to Instructor's Regular Load of College Classes	Number of College Classes Lessened for Instructor to Include Community Class	Instructor Assigned to Community Class by Director	Instructor Allowed to Make Decision about Taking Community Class	Instructor Donates Services to Community Class	Instructor Receives No Extra Salary Because Community Class is Included in Regular Teaching Load	Instructor Receives Payment for Services from Fees Paid by Members of Community Class	Instructor Paid Additional Salary by Institution for Community Class	Expenses for Community Classes Charged to Women's Physical Education Department	Expenses for Community Classes Charged to Combined Men's and Women's Phys. Ed. Dept.	Expenses Charged to the College Administration	Expenses Charged to Extension Department	Self-Sustaining Account
Arkansas		2											√				
Colorado			1			√	√			√							
Delaware Women's College		2	2	2	√			√	√				√				
Georgia			1		√		√				√		√				
Illinois		2	2	6	√			√	√				√				
Indiana	o	o	2		√			√				√				√	
Purdue			3			√		√		√			√				

Iowa			1	2		√	√		√			√								
Michigan	8	2	4	1	√			√	√											
Minnesota	11	4	11		√		√			√			√							
Missouri	1	2	3	1	√			√	√				√							
Montana									√						√					
New Hampshire								√							√					
North Dakota		7	5	8				√			√									
Ohio			2	1	√			√				√			√					
Ohio State			3	1	√			√	√		√				√					
Cincinnati	3–5	2	3	1		√	√			√					√					
Oklahoma	1	1			√		√			√			√		√					
Oregon		2	1	1	√			√			√		√							
Texas			2	1	√		√		√										√	
Utah	1	2	2	1	√			√	√		√				√		√			
Washington			2	1				√			√								√	
Wisconsin			1–2			√				√										
Wyoming										√										

TABLE IV

MASTER CHART OF ADMINISTRATIVE PROCEDURES OF PHYSICAL EDUCATION DEPARTMENTS FOR WOMEN IN TEACHERS' COLLEGES FOR CLASSES IN LEISURE-TIME ACTIVITIES OFFERED FOR MEMBERS OF THE COMMUNITY

Teachers' Colleges	Number of Instructors Involved in Program for Community				Relation of Community Class to Instructors' Schedule		Method of Obtaining Instructors for Community Class		Financial Arrangement with Instructor for Community Class				Financial Arrangement of Department for Community Classes			
	Number of Instructors on Duty with Community Group but not Instructing	Greatest Number of Hours per Week Instructors on Duty but not Instructing Community Group	Number of Instructors Teaching Classes for Community Group	Greatest Number of Classes per Instructor for Community Group	Community Class in Addition to Instructor's Regular Load of College Classes	Number of College Classes Lessened for Instructor to Include Community Class	Instructor Assigned to Community Class by Director	Instructor Allowed to Make Decision about Taking Community Class	Instructor Donates Services to Community Class	Instructor Receives No Extra Salary Because Community Class is Included in Regular Teaching Load	Instructor Receives Payment for Services from Fees Paid by Members of Community Class	Instructor Paid Additional Salary by Institution for Community Class	Expenses for Community Classes Charged to Women's Physical Education Department	Expenses for Community Classes Charged to Combined Men's and Women's Phys. Ed. Dept.	Expenses Charged to the College Administration	Expenses Charged to Extension Department
Santa Barbara St. Tea. College, Calif			2													
Colorado St. Col. of Education, Greeley			2		√			√			√				√	
Moorhead St. Teachers' Col., Moorhead, Ky.	1	2														
Eastern Ky. St. Teachers' College, Richmond	1		1	1		√	√			√					√	
Louisiana St. Normal College, Natchitoches		3	2		√			√		√						

Michigan State Teachers' College, Ypsilanti			5			√	√					√
State Teachers' College, St. Cloud, Minn.	1				√			√	√			√
State Teachers' College, Cape Girardeau, Mo.	1						√					
Kearney St. Teachers' College, Kearney, Nebraska			1		√			√		√		
State Teachers' College, Keene, New Hampshire	1	2	1	1	√			√	√			√
Southeastern Teachers' College, Durant, Okla.					√				√			
State Teachers' College, Slippery Rock, Pa.	1	1	3	1	√		√		√			
Northern Normal and Ind. Sch., Aberdeen, So. Dakota ..	3		2	2		√	√			√	√	
State Teachers' College, Fredericksburg, Va.			1			√	√			√		√

Measuring Reaction Time of Athletes

By Royal H. Burpee and Wellington Stroll

Y.M.C.A. of the City of New York,
William Sloane House

SEVERAL years ago when Babe Ruth was tested at the psychological laboratories of Columbia University it was found that the Bambino's reaction time was twice as fast as the average. Obviously this is a tremendous advantage when facing a pitcher for it enables him to wait and study the ball longer before starting his swing.

Reaction time is important not only in batting but also in many other physical education activities. The short dashes have long been characterized as speed events and the use of terms such as "playing fast ball," "a quick recovery," "slowing up," etc. indicates that the importance of speed in other events has been recognized.

Reaction time has been tested in several ways: tapping with a stylus, the veneer chronoscope, etc. These tests have been made for two purposes: to classify students' abilities in sports and for research. Performance time in short dashes has been almost exclusively used for classification, and substantial correlations have been found between such records and performance in other activities. Speed of tapping has been used frequently as a measure of reaction time for research purposes. In these tests the subject is required to tap as quickly as possible with a stylus. The number of taps he performs in a given period indicates his speed of reaction. Instruments of precision such as the chronoscope have also been used. In these studies the time is measured which elapses between the presentation of a stimulus and the response. Usually the stimulus is the ringing of a bell or a spoken word and the response, the pressing of a telegraph key.

In physical education we are not concerned primarily with an individual's pure reaction time but with his quick and accurate response to situations in sports. We need to know not only how quickly he can react by pressing a key but also with what speed and accuracy he can move six to ten feet in catching a ball, tagging out a player, hitting a puck, tennis ball, hand ball, or volley ball.

Although several splendid attempts have been made to isolate the factors involved in attaining success in physical education activities, few if any have attempted to measure the importance of reaction time. This is largely because suitable apparatus has not usually been available.

It should be of value both for classifying students for participation in sports, and for research purposes, if reaction time could be taken

quickly and accurately for each type of movement. The writers have attempted to construct an instrument that would facilitate the taking of such measurements.

THE INSTRUMENT*

The apparatus (Diagram A) consists of a board seven feet high and one foot wide, held vertical by a base and supports. On the top are attached two cone-bearing pulleys in such a manner that two strings

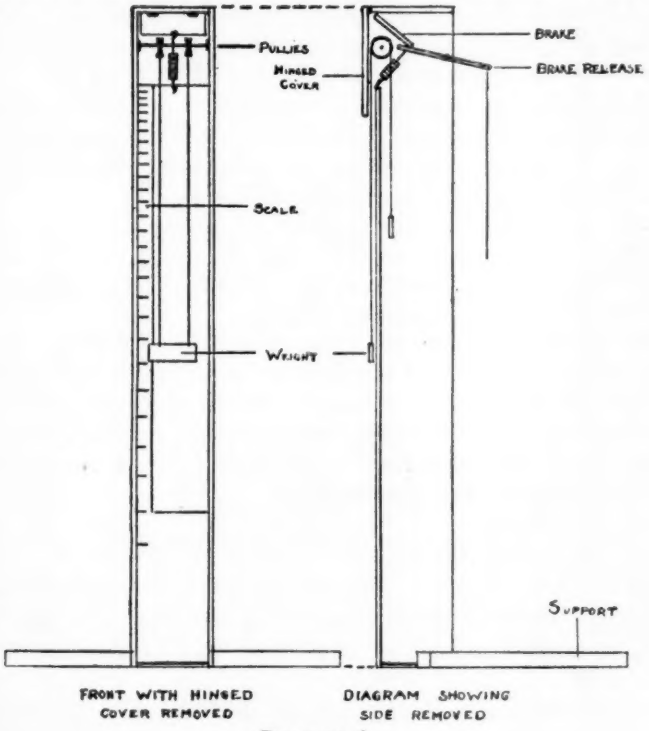

DIAGRAM A

passing over the pulleys will clear the front and rear surfaces of the board. A rectangular piece of sheet brass is attached to the front ends of the strings, and a similar but lighter weight is attached to the rear ends. Also fastened to the top of the instrument are a brake and a release to control the movement of the pulleys. The pulleys, brake, and release are screened from view by a hinged cover twelve inches in length. The front weight when at the top of the board is also concealed by this cover.

* The writers wish to acknowledge the splendid assistance rendered by Dr. George Pegram, Head of the Department of Physics, Columbia University, in checking the original designs and making available the instruments used in determining the acceleration.

METHOD

The front weight is brought to the top and held in this position by means of the brake. The brake is released and the weight descends from under the cover. The response required is to stop the descending weight by slapping it against the vertical board. That time which elapses between the stimulus and response is read in hundredths of a second directly from the scale attached to the face of the instrument.

Two types of reaction are tested: small- and large-muscle reaction. The first brings into play the small muscles of the hand. The second demands the use of the large-muscle groups—legs, arms, etc.

When testing his small-muscle reaction time the subject stands before the instrument at a convenient distance with his open hand directly below the hinged cover. When the rectangular stimulus drops, he smacks his hand against it as quickly as possible.

Large-muscle reaction time is tested by having the subject six feet away from the face of the machine. The movement required here is a leap, to bring the body within striking distance, and a forward thrust of the hand to contact the moving weight.

This test elicits a type of reaction quite different from the usual reaction tests administered in psychological laboratories. Successful permrfoance with our apparatus appears to depend upon pure reaction time, explosive energy, physical fitness, form, and other factors. The justification for the use of this method is that it tests a type movement very common in physical education activities.

RELIABILITY OF THE INSTRUMENT

The reliability of the instrument depends primarily upon the acceleration of the descending weight. The acceleration or increase in velocity should be constant for equal intervals. If not, the instrument will be unreliable.

Freely falling bodies have a uniform acceleration of thirty-two feet per second per second; in two seconds, the range decided upon for the instrument, such a body would fall sixty-four feet. As this distance is impractical for the measurement of reaction time it was necessary to reduce the velocity. This was accomplished by means of the counter weight; this addition introduced factors that tended to influence adversely the uniformity of the acceleration: (1) the weight of the strings, (2) the inertia of the pulleys, (3) the friction of the pulley bearings.

Instead of attempting to take these into consideration and revising our formula accordingly, we tried to make these factors so small that they would not affect the accuracy of our machine 1 per cent. To overcome the effect of the weight of the strings changing from a decelerating force to an accelerating force as the weight dropped, we made the two weights heavy enough so that the difference in their weights was

over one hundred times the weight of the strings. To overcome any effect of the inertia of the pulleys we obtained the lightest construction bakelite pulleys obtainable. Effect of friction in the bearings was reduced by our using cone bearings having a point contact.

The success of our attempts to reduce the effect of these factors was determined by accurately measuring the actual acceleration of the completed instrument by using an intermittent spark passing from the falling weight through a strip of wax paper and grounding on a strip of tinfoil that was attached to the scale. The frequency of the spark was governed by a can attached to a synchronous motor. (Diagram B.)

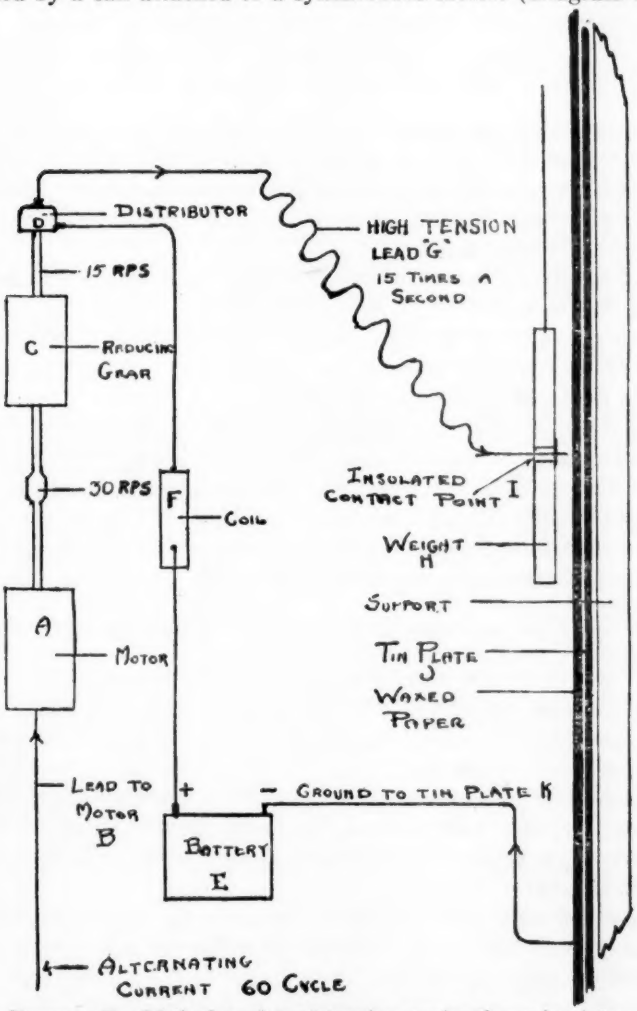

DIAGRAM B.—Method used to determine acceleration using intermittent sparks of known frequency.

Five such tests were made, the results being as follows:

TABLE I

ACCELERATIONS AS DETERMINED WITH INTERMITTENT SPARK OF KNOWN FREQUENCY

Test	Acceleration (Millimeters per 1/15 sec.)
1	4.81
2	4.885
3	4.94
4	4.857
5	4.846

Range — .13 millimeters
Average—4.8676 millimeters per 1/15 second

Inspection of the results indicated that the variability is largely caused by the deflection of the spark as it jumps from the weight to the tinfoil ground, and not by any inherent weakness in the instrument. We therefore assumed the acceleration of weight to be uniform and 4.8676 mm. in magnitude.

Our standardizing instruments were so constructed that the acceleration was measured for fifteenths of a second. As it was desired to calibrate the scale of the instrument in hundredths of a second it was therefore necessary to convert the acceleration to this interval. The formula used was derived as follows:

Let $S = \frac{1}{2} A T^2$ in which: S = distance the weights will fall; A = acceleration in units of time; T = time the weight falls.

Let $S = \frac{1}{2} A_1 T_1^2$ = the distance the weight will fall when time is expressed in units of 1/15 second. Let $S = \frac{1}{2} A_2 T_2^2$ = the distance the weight will fall when time is expressed in hundredths of a second.

The distance being the same, $\frac{1}{2} A_2 T_2 = \frac{1}{2} A_1 T_1^2$. And, $A_2 = \frac{A_1 T_1^2}{T_2^2}$. Substituting in the formula we derive a value for A_2 of .109518 mm = acceleration for each 1/100 of a second.

The distance the weight will fall at the end of each successful interval of 1/100 of a second was determined by means of the formula: $S = \frac{1}{2} A T^2$.

The units of the scale vary in size from .2 mm for the first interval to 20 mm for the 184th interval. To insure greater accuracy the first 50 intervals are masked by the hinged cover and the scale is started at the 50th interval.

The range most frequently used is between the 100th and the 150th interval. The average size of the intervals in this range is 15 mm. This is practically 4 times the greatest error found in the 5 tests used to determine the acceleration. Measurements to one hundredths of a second should therefore be well within the limits of accuracy of the machine.

THE RELATION BETWEEN SPEED OF REACTION AND PARTICIPATION IN PHYSICAL EDUCATION ACTIVITIES

Forty-six men, all residents of an urban club that offered gymnasium facilities as a membership privilege were tested with this instrument. The gymnasium facilities were located in the building in which they resided, and, physically at least, were equally available to all men. Organized group activities in handball, baseball, basketball, volleyball, badminton, table-tennis, boxing, wrestling, and tennis were conducted. Facilities for individual exercise were also available.

Each man was interviewed and the amount and kind of his participation in physical education activities determined. They were then classified into four groups on the following basis:

Group 1.—Men who participated regularly with marked success; such as membership on representative teams, etc.

Group 2.—Men who participated regularly with average success.

Group 3.—Men who participated irregularly.

Group 4.—Men who did not participate at all.

All men were given both the small-muscle reaction test and the large-muscle reaction test. To insure uniform starting conditions in the large-muscle test the start was made upon a gymnasium mat held securely in place by means of ropes.

TABLE II

REACTION TIMES OF MEN WHO PARTICIPATED REGULARLY WITH MARKED SUCCESS

Name	Small-Muscle Reaction Time	Large-Muscle Reaction Time	Name	Small-Muscle Reaction Time	Large-Muscle Reaction Time
1. R	.16 seconds	.68 seconds	8. C	.14½ seconds	.74 seconds
2. B	.17 seconds	.72 seconds	9. S	.14½ seconds	.67 seconds
3. P	.19 seconds	.79 seconds	10. RL	.12 seconds	.69 seconds
4. W	.15 seconds	.56 seconds	11. H	.14 seconds	.76 seconds
5. A	.14½ seconds	.68 seconds	12. S	.12½ seconds	.67 seconds
6. M	.14½ seconds	.68 seconds	13. ST	.11 seconds	.74 seconds
7. O	.10½ seconds	.57 seconds	14. S	.11½ seconds	.75 seconds

Small-Muscle Reaction Time		Large-Muscle Reaction Time	
Number	14	Number	14
Range	.11—.1925	Range	.56—.79
Average	.1404	Average	.6928

TABLE III

REACTION TIMES OF MEN WHO PARTICIPATED REGULARLY WITH AVERAGE SUCCESS

Name	Small-Muscle Reaction Time	Large-Muscle Reaction Time	Name	Small-Muscle Reaction Time	Large-Muscle Reaction Time
1. BS	.16 seconds	.65 seconds	6. TH	.15 seconds	.67 seconds
2. CA	.18 seconds	.73 seconds	7. MG	.19 seconds	.88 seconds
3. St.	.18 seconds	.72 seconds	8. EW	.11 seconds	.79 seconds
4. SW	.15 seconds	.73 seconds	9. FGP	.185 seconds	.82 seconds
5. RO	.17 seconds	.65 seconds			

Small-Muscle Reaction Time		Large-Muscle Reaction Time	
Number	9	Number	9
Range	.11—.185	Range	.63—.88
Average	.1639	Average	.7133

TABLE IV

REACTION TIMES OF MEN WHO PARTICIPATED IRREGULARLY

Name	Small-Muscle Reaction Time	Large-Muscle Reaction Time	Name	Small-Muscle Reaction Time	Large-Muscle Reaction Time
1. FA	.15 seconds	.81 seconds	7. RH	.11 seconds	.83 seconds
2. ST	.20 seconds	.79 seconds	8. RO	.17 seconds	.76 seconds
3. WL	.19 seconds	.80 seconds	9. BE	.14 seconds	.83 seconds
4. TU	.17 seconds	.75 seconds	10. SG	.13 seconds	.80 seconds
5. EU	.16½ seconds	.72 seconds	11. SW	.14 seconds	.65 seconds
6. PU	.19 seconds	.81 seconds			

Small-Muscle Reaction Time		Large-Muscle Reaction Time	
Number	11	Number	11
Range	.11—.20	Range	.65—.89
Average	.1550	Average	.7866

TABLE V

REACTION TIME OF MEN WHO DID NOT PARTICIPATE

Name	Small-Muscle Reaction Time	Large-Muscle Reaction Time	Name	Small-Muscle Reaction Time	Large-Muscle Reaction Time
1. SW	.14 seconds	1.00* seconds	7. MC	.22½ seconds	.90 seconds
2. NI	.20 seconds	1.00* seconds	8. HC	.18 seconds	1.00* seconds
3. SM	.14 seconds	1.00* seconds	9. JG	.17 seconds	.81 seconds
4. NA	.13 seconds	.84 seconds	10. BL	.14 seconds	1.00* seconds
5. FC	.13 seconds	.75 seconds	11. RL	12 seconds	.81 seconds
6. FP	.14½ seconds	.78 seconds			

Small-Muscle Reaction Time		Large-Muscle Reaction Time	
Number	11	Number	11
Range	.12—.225	Range	.75—1.00
Average	.1563	Average	.8818

* Reaction time estimated; individual unable to arrest the descent of the weight.

TABLE VI

SUMMARY OF GROUP RESULTS

Group	Number	Small-Muscle Reaction Time		Large-Muscle Reaction Time	
		Range	Average	Range	Average
I*	14	.11—.19 sec.	.1404 sec.	.56— .79 sec.	.6928 sec.
II*	9	.11—.185 sec.	.1639 sec.	.63— .88 sec.	.7133 sec.
III	11	.11—.20 sec.	.1550 sec.	.65— .89 sec.	.7866 sec.
IV	11	.12—.225 sec.	.1563 sec.	.75—1.00 sec.	.8818 sec.

Correlation between participation and small-muscle reaction time C = .401.

Correlation between participation and large-muscle reaction time C = .654.

* Inspection of the individual results discloses the fact that all men who participated regularly (Group I and II) have a reaction time of .80 seconds or better with two exceptions; MG who has a reaction time of .88 seconds, and FGP whose reaction time is .82 seconds.

MG is a good boxer and is training regularly. He has never participated in any other form of physical education and later efforts to help him do so were unsuccessful.

FGP is enlisted in the U. S. Army and plays handball regularly at the company post. He is 26 years of age, 6 feet 3 inches in height, and weighs 175 lbs. His small-muscle reaction time was .185 seconds.

SUMMARY

The writers have attempted to construct an accurate, dependable, sturdy chronoscope that could be used in the gymnasium for the measurement of the reaction time of athletes.

The instrument is of the Atwood Machine type, in which two weights of unequal mass are connected by a flexible connection which passes over a pulley.

Intervals of time are measured by the distance the heavier weight descends.

The accuracy of the instrument depends primarily upon the uniformity of the acceleration of the weights.

The acceleration was determined mechanically by means of an intermittent spark of known frequency and was found to be uniform.

The determined acceleration was converted to acceleration in terms of hundredths of a second by means of appropriate mathematical formulae.

Forty-six men who differed in their habits of participation in physical education activities were tested with the instrument. Coefficients of Mean Square Contingency were computed between habits of participation and small-muscle and large-muscle reaction time; these were as follows: Participation and small-muscle reaction time $C = .401$; participation and large-muscle reaction $C = .654$.

There appears to be a significant negative relationship between small-muscle reaction time as tested with this instrument and successful

participation in physical education activities. Fast small-muscle reaction time appears to be an important factor in attaining marked success in these activities.

There appears to be a large negative correlation between large-muscle reaction time as tested, and successful participation in these activities.[1]

[1] The maximum value which a *C* can take in a 4 x 4 fold table—the one in our data—is .866. As the *C* found in our data is .654 we are justified in concluding—that there is a large negative correlation between the two measures. The correlation is negative, for the shorter the reaction time the larger and more successful the participation tends to become.

Criteria for Studying and Evaluating Physical Education Programs with Relation to Their Leisure-Time Contributions*

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THE PROBLEM

WE PROPOSED to establish a tentative set of yardsticks by which it would be possible to evaluate the recreation work of any city, and thence to be able to make comparisons between cities. These criteria are also proposed as standards to be worked toward by any city. Being only tentatively established, trial and constructive criticism are invited. Circumstances and further study will change the numerical values set, no doubt, but the *plan* is offered as a challenge to further study of recreation work and of recreation programs.

As usual, the matter of interpretation of the subject assigned had to be decided upon before proceeding and four plans were considered:

1. Should we include just the work of gym and athletic field?
2. Should we confine ourselves to schools or take city-wide facilities and recreation programs, too?
3. Should we try to evaluate each event of an activities program as to its individual value for leisure usage? (This has been much discussed in the literature, and would involve the details of a tests and measurements table.)
4. Should we take a broad view of health and physical education in its many ramifications that relate to the education for and use of leisure of an entire city population, including both school age and adult?

For such complete teaching as will be needed in the near future, with our changing social and economic status, we took the most inclusive interpretation of our scope and chose number four.

ACKNOWLEDGMENT

A report of this kind is made up largely of our own computations and conclusions, but these were made or drawn only after we had made

* This paper was prepared as one of four reports on a "Study of the Contributions of Physical Education to Use of Leisure" made at the Recreation Section of the National Convention of the American Physical Education Association, April, 1935, at Pittsburgh, Pa.

a critical study of what is being done successfully in cities whose reputations speak for their progressiveness. Many state manuals were checked and compared, the surveys of the United States Bureau of Education were studied, and by averaging standards in general use and comparing them with the best practices in our most progressive cities, we arrived at what we hope are fair values for our criteria at the present time. *For the most part they are under the maximum in existence but are above the average.* The items taken separately represent practices that *may* possibly be found existing some place, but nowhere are they collected or found existing in any one city or state program. Tabulated and computed as described, these criteria therefore represent practical rather than just theoretical goals.

In our scoring procedure we followed the plan used by the National Recreation Association so as to show comparable values for further study, and so as to add to their survey some other considerations suitable to our different approach. Their survey covered only recreation that is open to the *entire* community. An outline of their headings, each marked with an asterisk(*), is included with ours only for the sake of completeness. This outline and scoring procedure are used with their full knowledge and consent and we are glad to take this opportunity to thank them not only for this cooperation but for their willing assistance and suggestions in other directions.

OMISSIONS

Excellent leisure-time training and education are achieved through many other than physical education programs no matter how broad our interpretations. We have had to omit such agencies and activities as libraries, museums, night schools, extension courses, art galleries, churches, fraternal organizations, parish houses, and many others.

We have encroached upon the dramatic field in including stunts and amateur theatricals used in playgrounds and camps; upon art in including handcrafts similarly used; and upon music used extensively in recreation work coming under our supervision. But we have omitted the broader applications and greater contributions of these specific fields necessary to the complete development and enjoyment of any individual.

From our own physical education programs we have omitted many portions that are of great value to the individual in enabling him to enjoy leisure but which are not directly contributory to what he does *during* his leisure time, e.g., our health service, hygiene instruction, plant sanitation, corrective department and its service, clinical work, and our work in social relations and home contacts.

METHOD AND PROCEDURE

After selecting and grouping the fourteen items needing to be evaluated, we worked out a rating scheme based upon a one-hundred-point

score. This was superseded, as soon as we found it, by the similar but much more completely *weighted* scoring method used by the National Recreation Association, whose previously mentioned survey on evaluation was the only one on this problem that we were able to find. Referring to the "Outline" chart, note that a maximum number of one hundred points each is assigned to our fourteen selected groupings with their respective subdivisions, details on which will be found in later charts. The city being studied is first rated on each grouping in proportion to its attainment on the details of that grouping; this simple rating is then multiplied by the factor representing weighting so as to take into consideration the importance of the item in relation to the whole program, and so as to make a weighted rating which is a better basis for intercity scoring; and last, the sum of the weighted ratings divided by one hundred gives the per cent efficiency of that recreation program.

If you are using the outline for self-checking, only the first simple rating is needed to compare one part of the program with another, as the differences in importance of the details are taken care of by the subdivision differences in evaluation: e.g., in item five, total acreage is more important than beautification and rates forty as compared with five.

For intercity comparisons the weighted rating seems best because, for example, one city may rate high in expenditures and administration but poor in personnel; most students would not consider it superior in spite of the high points it might thus score on the simple rating plan. *Who* teaches and *what* he teaches surely should be far more important than the amount of money spent, and only a weighted scoring would indicate this accurately.

Details, by which to be guided in determining how close to the maximum a rating should be, are to be found in the accompanying charts, if the items are a part of the authors' study, or are to be found in the "Appraisal" if they are a part of the study made by the National Recreation Association. (These latter are the ones marked with an asterisk (*) on the "Outline.") Take, for example, item one, "Personnel in the School System": the "Academic Requirements" have been subdivided in the detail chart explaining this item, and the total of thirty points possible is shown to be made up of three ten-point subdivisions upon which the system is to be rated as pertains to its director, supervisor, and teacher requirements; the person rating assigns from one to ten points as the simple rating on each of these three subdivisions; similarly he assigns values from one up to the maximum allowed for each of the six details under "Selection," and for each of the four details under "Load." Inasmuch as the maximum total of points is always one hundred, it is to be seen at a glance what per cent of the standard the score is in the simple rating in any of the fourteen groupings. Detail charts follow for group-

ings one, three, four, seven, eight, eleven, and thirteen, studied by the authors. Number thirteen is offered with hesitation as time did not permit securing adequate data for it to be truly representative or as thorough a study as the others.

CONCLUSION

In the criteria charts certain desirable goals have been expressed in tangible form. A word picture of a desirable recreation schedule and plan has been painted. What will you do with it? At first glance the whole study seems rather academic. It *can* be more. If you are to profit you must use it. May we suggest:

1. That you evaluate your own situation.
2. That you call the plan to the attention of your superintendent or higher authority, and paint to him the contrast between your own and an ideal situation.
3. That you try to advance your own status step by step, not overlooking the fact that Federal funds might be available to help you get started.
4. That by doing this you will *be a part* of a movement to standardize good recreation programs.

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OUTLINE OF CRITERIA

	Maximum Points	Rating	Weight Factors Weighted Rating
1. Personnel in the School System			
A. Academic Requirements	30		
B. Selection	30		
C. Load	40		
	100		× 15 =
2. Personnel in Community Recreation			
*A. Number	50		
*B. Training and Qualifications	45		
*C. Selection and Training Methods	5		
	100		× 15 =
3. Program Content, School and Community			
A. Physical Recreation	40		
B. Other Types Recreation	60		
	100		× 10 =
4. Recreation Facilities of the School System, Indoor and Outdoor			
A. Elementary	50		
B. High School	50		
	100		× 10 =
5. Recreation Facilities Available Outdoors to the Entire Community			
*A. Total Acreage	40		
*B. Playgrounds and Playfields	40		
*C. Maintenance and Beautification	5		
*D. Development of Special Recreation Areas	15		
	100		× 10 =
6. Recreation Facilities Available Indoors to the Entire Community			
*A. Recreation Center Facilities	75		
*B. Field and Shelter Houses	25		
	100		× 10 =
7. Methods			
A. Pedagogy Applied to the Program	40		
B. Pedagogy Applied to the Teacher	40		
C. Philosophical Consideration	20		
	100		× 5 =

* Work of the National Recreation Association. See their *Schedule for the Appraisal of Community Recreation.* Price $.50.

	Maximum Points Rating		Weight Factors	Weighted Rating
8. Time				
A. General Community Recreation	30			
B. School Physical Education and Recreation	30			
C. Other Recreational Activities that Overlap	40			
	100	×	5 =	
9. *Time Service per Capita in Community	100	×	5 =	
10. *Attendance per Capita in the Community	100	×	3 =	
11. Administration in the Schools	100	×	3 =	
12. *Administration in Community Recreation	100	×	3 =	
13. Finance in the Schools	100	×	3 =	
14. *Finance in Community Recreation	100	×	3 =	
Highest possible total	= 1400		100	10,000

Weighted Rating ÷ total factors = per cent efficiency.
Maximum efficiency possible = 10,000 ÷ 100 = 100 per cent.

Instruction for use:

1. Rate each item *proportionately* to maximum points allowed, and add.
2. Multiply your rating by weight factor, getting weighted rating.
3. Add weighted ratings, and divide by 100 to get *per cent efficiency rating* for all.

DETAIL CHARTS FOR THE FOURTEEN GROUPINGS ON THE OUTLINE

1. Personnel in the School System
   - A. Academic Requirements ..... 30 Pts.
     - 1) Director: an M.D. or a Ph.D. in Med. Sc. or Pub. Health (10)
     - 2) Supervisors: Master's degree and 5 years' teaching exp. (10)
     - 3) Teachers:
       - High: Bachelor's degree with major in physical education from an accredited college, plus two years' teaching experience (5)
       - Elementary: Normal School graduates, with major in physical education, *or* Bachelor's degree from an accredited college with at least a minor in physical education (5)
   - B. Selection ..... 30 Pts.
     - 1) Private use of own leisure time (15)
     - 2) Competitive entrance examination for job (3)
     - 3) Observation of work on previous job, or equivalent (3)
     - 4) Waiver of any local residence requirement (3)
     - 5) Recommendation and rating from previous job (3)
     - 6) Professional reading and professional membership interest (3)
   - C. Load (Full credit only if max. not exceeded) ..... 40 Pts.
     - 1) Max. of 25 scheduled classes per week (60 min. each) (10)
     - 2) Max. of 10 play and intramural periods per week (10)
     - 3) Max. of 5 consultation and clerical periods per week (10)
     - 4) Max. of 250 different pupils per teacher (10)

* Work of the National Recreation Association. See their *Schedule for the Appraisal of Community Recreation.* Price $.50.

2. Personnel in Community Recreation
For details on the three subheadings of the outline see National Recreation Association, *Appraisal*. See bibliography.

3. Content of Program, School and Community

A. Physical Recreation ..... 40 Pts.

1) Team games (football, basketball, hockey, etc.)	(5)
2) Aquatics	(5)
3) Dancing	(5)
4) Games of low organization	(5)
5) Individual athletic events (track, golf, tennis, etc.)	(5)
6) Gym and playground activities (stunts, exercises, etc.)	(5)
7) Relay racing	(5)
8) Combative (fencing, boxing, wrestling)	(5)

B. Other Types Recreation ..... 60 Pts.

1) Handcrafts (leather, metals, wood, soap, airplanes)	(5)
2) Home interest activities (camp cooking, etc.)	(5)
3) Musical recreation (chorus, orchestra, etc.)	(5)
4) Art recreation (nature painting, etc.)	(5)
5) Nature study (birds, trees, animals, etc.)	(5)
6) Hiking (use of shelters and overnight cabins)	(5)
7) Hobbies, clubs, discussion groups, lectures, etc.	(5)
8) Dramatics (amateur theatricals, stunt nights, etc.)	(5)
9) Summer activities projects (Lies, p. 182)	(5)
10) Related activities services (Lies, p. 226)	(5)
11) Seasonal activities of social nature (Lies, p. 227)	(5)
12) Camping, touring, fishing, hunting, etc.	(5)

100 Pts.

4. Recreation Facilities of the School System, Indoor and Outdoor

A. Elementary ..... 50 Pts.

Facility for School Population of	300	500	1000	2000	Pts.
1) Gym 50 x 60	1	1	2	2	(10)
2) Playground 4 acres with track pits	1	1	1	2	(10)
3) Pool 25 x 60	0	1	1	1	(5)
4) Auditorium with stage	0	1	1	1	(5)
5) Farm home for subnormals part time, week-ends for normals	0	0	1	1	(5)
6) Outing cabins for hiking	1	1	2	2	(5)
7) Tennis courts	1	2	4	4	(3)
8) Locker-dressing-room, 1,000 sq. ft.	1 (alt)	2	2	4	(2)
9) Shower-room, 24 outlets	1 (alt)	2	2	4	(2)
10) Gym office, private shower	0	2	2	2	(2)
11) Teamroom, 12 x 20	0	0	1	1	(½)
12) Storeroom, adjacent to office	0	0	2	2	(½)

B. High School (Junior or Senior) ..... 50 Pts.

Facility for school population of	500	1000	2000	4000	Pts.
1) Gym 60 x 90	1	1	2	3	(8)
2) Play and athletic field by acres	4	8	12	16	(8)
3) Pool 30 x 75	1	1	1	2	(8)
4) Auditorium, stage, props	1	1	1	1	(6)
5) Quiet game room and lounge	0	1	1	2	(4)
6) Outing cabins for hiking	1	1	2	4	(4)

7) Camp for overnight and week-ends	1	1	1	2	(1)
8) Tennis courts	2	4	8	16	(1)
9) Bowling alleys	2	4	6	8	(1)
10) Archery range indoors (small alleys)	2	4	6	8	(1)
11) Golf driving range indoors (small alleys)	2	4	6	8	(1)
12) Track pits indoors, jumping and vaulting	0	2	2	4	(1)
13) Locker- and dressing-rooms, 1,000 sq. ft.	1	2	2	4	(1)
14) Shower-room, 24 outlets	1 (alt)	2	2	4	(1)
15) Gym office with private shower	2	2	2	4	(1)
16) Corrective room with mats and blankets	0	1	2	2	(1)
17) Storeroom off office	1	2	2	2	(½)
18) Apparatus room off gym	0	1	1	1	(½)
19) Varsity teamroom (boys)	0	1	1	2	(½)
20) Visiting teamroom (boys)	0	0	1	1	(½)

5. Recreation facilities available outdoors to the entire community. For details see National Recreation Association *Appraisal.*
6. Recreation facilities available indoors to the entire community. For details see National Recreation Association *Appraisal.*
7. **Methods**

A. Pedagogy Applied to the Program.....40 Pts.

Does the Program:

1) Meet age-need requirements? Of the individual? Of the group? Of all groups to be covered? Provide for growth, development, interest, ability, vocation, psychological needs, etc. (2)
2) Provide balanced activities? For all-round physical needs, and for variety in skills needed; is it all competitive, all large group, all individual skills, all social, all quiet games, etc. (2)
3) Provide variety for all types of occasions? Does it give material for use in gym, at picnics, parties, home evenings, clubs, churches, for social and commercial sports opportunities? (2)
4) Show suitable progression and advancement over preceding portions and skills? (2)
5) Give opportunity for pupil group-leadership? Officiating, monitorships, etc.? (2)
6) Give opportunity for self-direction on part of the class *vs.* all-teacher control? (2)
7) Give opportunity for pupil choice of activity, initiative, and creativeness? (2)
8) Provide opportunities for training in social conventionalities and courtesies? (2)
9) Stimulate social amenities? Play with friends, making of new friends, supplying need of companionship? (2)
10) Include definitely planned situations for practice in the fundamental character traits? (2)

11) Equip each individual with a fund of usable recreational knowledge? (2)
12) Furnish opportunity for individual self-expression? (2)
13) Cause participants to lose selves in activity—is it truly recreational? (2)
14) Provide all-year-round service? (2)
15) Use fundamental skills all know or that are easily acquired (*vs.* require highly specialized skills)? (2)
16) Cover a broad range of tastes and interests? (2)
17) Require varying degrees of mental and physical energy? Does it alternate these skilfully? (2)
18) Cover broad enough scope to be worth the cost? (2)
19) Service large enough number of people to be worth the cost? This implies the intramural *vs.* the varsity type use of equipment and personnel. (2)
20) Provide for the growth and development of hobby groups and pupil use of own time for the activities? (2)

B. Pedagogy Applied to the Teacher.....40 Pts.

Does the Teacher:

1) Keep the majority of the class enjoyably interested? (2)
2) Keep entire class busy most of the time? (2)
3) Comment on opportunities met well or poorly—really *teach* during the activity? (2)
4) Create situations requiring responses that show up character traits and then *label* them and point them out? (2)
5) Provide fun and spontaneous enjoyment and laughter opportunities? (2)
6) Use squads and democratic cooperation under student leaders *vs.* old formal discipline? (2)
7) Use available space to good advantage? (2)
8) Use all the available time in activity and *essential* explanation? (2)
9) Take the classes out-of-doors whenever possible? (2)
10) Provide small achievable goals to give the "success" feeling? (And to use in a definite grading method.) (2)
11) Adapt material for usage to either large or small groups? (2)
12) Indicate a professional attitude by a pleasant but business-like manner? (2)
13) Indicate a professional attitude by dressing appropriately for the activity and occasion? (2)
14) Indicate a professional attitude by giving what is obviously a planned lesson? (2)
15) Prove able to state objectives for the major parts of the lesson plan? (2)
16) Have mechanical details attended to by student assistants? (e.g., ventilation, lights, temporary equipment ready for use, roll taken without loss of activity time.) (2)
17) Secure immediate attention on signal? (2)
18) Preserve reasonable orderliness yet permit student self-directed activity? (As against teacher control of every movement.) (2)
19) Attend to technique details easily? (e.g., face class with back to light, change class positions often, organize groups quickly and simply, spend little time explaining and cautioning.) (2)

20) Select activities critically according to their value for achieving educational objectives? (2)

C. Philosophical Considerations ..... 20 Pts.

Does the program:

1) Meet present needs—economic, neighborhood, time? (1)
2) Contain some carry-over value material for adult preparation? (1)
3) Create a love of activity just for itself and for the exhilaration of being active? (1)
4) Create a love of being out-of-doors? (1)
5) Create appreciation of worthy companionship in clean and worthy activity? (1)
6) Cultivate physical health? Vigor, agility, strength, skill, increased physical efficiency? (1)
7) Cultivate social health? Cooperation, loyalty, good sportsmanship, the "beaming personality and character." (1)
8) Cultivate mental health? Cheerfulness, courtesy, and clear thinking, self-confidence, proper functioning of the emotions, absence of problems of discipline, wholesome mental attitudes, "mental stance and integrity?" (1)
9) Cultivate psychological health? "Satisfy instinctive impulses and cravings of adolescent nature, as desire for social intercourse, rivalry in stunts, instinct for play, love of social approval, and self-assertiveness. Bring out the unassertive, timid types. Give moral training through social contacts." (1)
10) Reduce the per cent of delinquency in neighborhoods where it exists? (1)
11) Furnish a wholesome substitute for "crime leaders" and worthless or harmful activities? (1)
12) Reduce or increase working efficiency? (1)
13) Provide for both participatory and spectator opportunities? Per cent each? (1)
14) Create an "active, energetic and happy citizen" *vs.* just fill in time? (1)
15) Really re-create, rest, relax, rejuvenate? (1)
16) Give a fresh outlook, and provide relief from the monotony of labor? (1)
17) Educate as well as recreate? (1)
18) Consider and make suitable use of current trends in commercial amusements (passive)—movies, radio, stadia? (1)
19) Consider and make suitable use of current trends in commercial amusements (participatory) golf, swimming, etc. (1)
20) Consider and make suitable use of current trends in private participation in auto touring and camping, hunting and fishing, winter sports clubs, etc.? (1)

100 Pts.

8. Time

A. General Community Recreation..... 30 Pts.

1) Playground (10)

* Full credit for one playground session under leadership for each 15 of total population.

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2) Neighborhood playfields (10)
* Full credit for one playfield session per 60 of total population.

3) Community center (10)
* Full credit for one community center session for each 200 population.

B. School Physical Education and Recreation.....30 Pts.

1) Gym and Outdoor Class activities (15)
Full credit on basis of weekly schedule of—
Elementary—10 x 30 minutes. (5 instr., 5 free)
High School—5 x 60 minutes. (all instr., 1 for hygiene)

2) Intramural activities (10)
Full credit on basis of weekly schedule of—
Elementary—2 x 60 minutes after school
High—2 x 60 minutes after school
Also, 2 play days/semester for each school

3) Varsity Type Athletics (from time player gets into his suit until he gets out of it, both practice and games) (5)
Full credit on basis of not exceeding a maximum of 4 x 120 minutes/week for high schools, and of 2 x 120 minutes/week for elementary school.

C. Other Recreational Activities that Overlap.....40 Pts.

1) Social recreation (5)
One hour/week, dancing, mixed group social games or equivalent activities

2) Nature activities (5)
Once/month minimum. Hikes, overnight camps, nature study club trips, etc,

3) Athletic activity Clubs (5)
One hour/week. Archery, bowling, etc.

4) Musical activities (5)
One hour/week. Chorus, orchestra, band

5) Dramatics (5)
One hour/week. Stunt programs, plays, etc.

6) Arts and crafts (5)
One hour/week. Handcrafts all kinds. Art

7) Hobbies (5)
One hour/week. Stamps, coins, anthologies, gardening, etc.

8) Miscellaneous club activities (5)
One hour/week. Discussion groups, lectures, travel study, debates, etc.

100 Pts.

9. Time Service per Capita in the Community.
See *Appraisal.*

10. Attendance per Capita in the Community.
See *Appraisal.*

11. Administration in the Schools
A. Organization ..... 70 Pts.
1) Director general (10)
2) Intramural Sports Supervisor—Boys (5)

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3) Intramural Sports Supervisor—Girls (5)
4) Class Period Supervisor—Boys (5)
5) Class Period Supervisor—Girls (5)
6) Misc. Activities Superv. (scouts, hobbies, clubs)—Boys (5)
7) Misc. Activities Superv. (scouts, hobbies, clubs)—Girls (5)
8) Full-time men teachers for boys (see max. load.) (10)
9) Full-time women teachers for girls (see max. load.) (10)
10) Medical supervisor as needed for athletics (5)
11) Orthopedic specialist for crippled child recreation (5)

B. Boards of Control, selected from the Staff.....30 Pts.

1) Athletic control board (5)
2) Class work control board (5)
3) Statistical board (budget, records, etc.) (5)
4) Educational board for staff meetings and lectures (5)
5) Publicity and extension of service board (5)

100 Pts.

12. Administration in Community Recreation.
See *Appraisal.*

13. Finance in the Schools.
A. Per cent total school budget for physical education expenditures†...50 Pts.
B. Per capita expenditure for physical education based on enrollment†..50 Pts.

100 Pts.

†NOTE.—Enough statistics could not be obtained by the study committee to warrant setting numerical values for the above. The methods of keeping cost accounts vary greatly. In some cities salaries are apportioned by departments and in others they are not, and in these latter, departmental budget amounts do not then represent total departmental costs. Best figures available in published form are contained in Lies' studies. These show a wide range. This problem is scheduled for next year's committee study in the Recreation Section.

14. Finance in Community Recreation. See the *Appraisal.**

* National Recreation Assn. *Schedule for the Appraisal of Community Recreation.*

A Study of the Amounts and Types of Physical Education Material Found in Education Magazines

By Florence M. Shearer
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PHYSICAL education, as a subject in the school curriculum, receives a great deal of attention from students, teachers, and members of the community. This is the natural and expected outcome when one considers that physical education in most schools is required of all students, and that it offers a great variety of activities which are easily adaptable to demonstrations and programs. Since this phase of the curriculum is of such interest to the groups mentioned above, it follows that physical education must be of real importance to the superintendents and principals as well. It is to be hoped that their attention takes the form of an active interest, and is accompanied by the desire to improve the physical education program.

As an indication of this, the amount of space devoted to physical education in twenty-one professional education magazines for the year 1932–33 was compared with that in the same magazines for 1934–35. These twenty-one magazines represent the group most commonly read and most easily available.

The names of the magazines and the number of each which have been used will be found in the accompanying chart. Some are published 12 times during the year, some weekly, and some only twice yearly. Using 21 different magazines with a total of 218 copies for 1932–33, and 220 copies for 1934–35, this study should be representative of the entire group of education magazines.

The method of study followed has been to look over the table of contents or index, and to investigate (1) all of the titles dealing with or appearing to deal with any phase of physical education; (2) the editorial items; (3) articles or digests from newspapers; and (4) books reviewed and books listed.

It has been difficult to find a suitable classification for these articles. Because a résumé of each would not add to the value of this paper, and in fact seems wholly unnecessary, a grouping has been used which will present as clear a picture as possible of the type of material found.

The results found may be placed in two divisions. The following two charts will show at once the type and amount of material in each magazine, and will give an analysis of that material.

Two conclusions may be drawn from this study. First, there is very little material on physical education printed in the education magazines. (*a*) Only 65 magazines of the 218 studied in 1932–33 had even as much as a book reference in physical education, while in 1934–35 this number increased to 95 magazines. Chart IV will show graphically the number of articles or references on physical education in education magazines over the year periods. (*b*) The total number of references appearing is 113 in 1932–33, and 220 for 1934–35. This averages, roughly, one

CHART I

Name of Magazine	Number Studied 1932–33	1934–35
1. American School Board Journal	11	12
2. Chicago School Journal	2	2
3. Education	9	9
4. Educational Administration and Supervision	9	9
5. Educational Method	8	8
6. Educational Record	3	3
7. Elementary School Journal	8	9
8. High School Journal	7	5
9. High School Quarterly	4	3
10. Journal of Education (Boston)	18	18
11. Journal of Education (London)	12	12
12. Journal of Educational Psychology	8	8
13. Journal of Educational Research	8	8
14. Journal of Higher Education	8	9
15. Journal of the National Education Association	8	8
16. Research Bulletin of the National Education Association	5	5
17. School and Society	52	52
18. School Executives Magazine	12	12
19. School Life	9	10
20. School Review	9	10
21. Teachers College Record	8	8
Total	218	220

article to each two magazines published in the first year, and over one article or reference to each magazine in 1934–35. Over 50 per cent of this material consists merely of books listed or reviewed, which draws attention to physical education but gives little enlightenment on the program and the ideals toward which physical education is striving. Chart V will show the number of each of these groups of articles for the two years.

Second, the type of material found is perhaps indicative of modern trends in physical education. For example, (*a*) in 1932–33, 37 per cent of the articles and material published was on the subject of athletics and competition. This was largely about football with some denouncement of the situation, and looking to a more ideal one in which a whole student body could participate and gain benefit. But in the present year,

CHART II
The Type and Amount of Material

Magazine No.	Phys. Ed. Articles 1932–33	Phys. Ed. Articles 1934–35	Editorials 1932–33	Editorials 1934–35	News Articles 1932–33	News Articles 1934–35	Articles Not Directly Phys. Ed. 1932–33	Articles Not Directly Phys. Ed. 1934–35	Sections on Phys. Ed. 1932–33	Sections on Phys. Ed. 1934–35	Books Reviewed 1932–33	Books Reviewed 1934–35	Books Listed 1932–33	Books Listed 1934–35	Totals 1932–33	Totals 1934–35
1	3	6		1				1				1			3	9
2	1					1					6	1	1		8	2
3	11		1					1				2	1	3	13	6
4													2	2	2	2
5	1			1				4						20	1	25
6	1														1	0
7							1	1			1	1	9	18	11	21
8		1													0	1
9			2											1	2	1
10	1	1			5	7	1				1				8	8
11												9	11	11	11	20
12													3	1	3	1
13	1					1						5		9	1	15
14	1					5					1	1			3	6
15	1	1				1		2						4	1	8
16						3		2							0	5
17	4	3					1	5	3		3			19	11	27
18		3						3			1				1	6
19	1					1	1	1					1		3	2
20	1	1		2			3				5	4	11	41	20	48
21	1				2				5			1	2	6	10	7
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Totals 21	28	16	3	4	7	19	8	20	8	0	18	26	41	135	113	220

CHART III

AN ANALYSIS OF MATERIAL

(The percentage represents the relation of each division to the total amount of material.)

Material	Percentages 1932–33	1934–35
Athletics	37+	21+
Justification of Physical Education	9+	1+
Recreation and Leisure Time	7+	39+
Physical Education and Health	5+	12+
Corrective and Posture	5+	1+
Physical Education and Individual Needs	5+	0+
Physical Education as Education	5+	1+
Physical Education Program	5+	12+
Physical Education Plant or Set-up	5+	5+
Physical Education in Europe	3+	1+
Physical Education Leaders	3+	1+
Differences in Boys' and Girls' Programs	1+	0
Physical Education Objectives	1+	0
Teacher Training	1+	0

the interest seems to be spreading to other fields, for only 21 per cent of the material is on this phase of physical education. (*b*) Nine per cent of the material in the magazines in 1932–33 was written in justification of physical education. The fact that some schools eliminated this subject from the curriculum during the depression may have been the cause for these articles. In the present year, the percentage held by this type has dropped to only 1 per cent, which may indicate that with the return of more normal times, the danger of decreasing the physical education program in the schools is lessened. (*c*) Seven per cent of the material in 1932–33 was written on recreation and leisure time. It has been shown repeatedly in the past few years that recreation has the possibilities of giving people in times of depression an outlet for nervous energy accumulated, a new outlook by reason of a better mental balance, and new contacts and friendships. The depression may yet prove to be one of the best champions that physical education has ever had. The high percentage of material (39), in the magazines for 1934–35 bears out the fact that there is an increasing interest in recreation and leisure time *per se* as well. (*d*) For the year 1932–33 no other type of

CHART IV

THE NUMBER OF ARTICLES IN EDUCATION MAGAZINES FOR EACH YEAR

Articles	Percentages 1932–33	1934–35
0–3	76	38
4–6	9	28
7–9	9	28
10 or more	4	4

material drew a great deal of attention. During 1934–35, however, considerably more stress was placed on the physical education program in the school; twelve per cent was written on this topic. It is hoped that this may be a favorable indication of the school administrator's attitude toward physical education. (*e*) During the two years that this study was made, an equal number of articles was written on the physical education plant and facilities. School administrators in the last few years are taking more pride and interest in the appearance and utility of the physical education facilities, both indoor and outdoor. (*f*) The remainder of the material is given less stress, and therefore must be considered less important than that to which reference has already been made. Two trends

CHART V

THE NUMBER OF EACH GROUP OF ARTICLES

Group	Number 1932–33	1934–35
Books Listed	41	135
Physical Education Articles	28	16
Books Reviewed	18	26
Sections of Physical Education	8	0
Articles not directly Physical Education	8	20
News Articles	7	19
Editorial Comment	3	4

were emphasized, however, in regard to teacher training which may be worth consideration. These are suggested changes which will (1) strengthen the fusion of health education and physical education, (2) meet the needs of the elementary school teacher not majoring nor minoring in physical education, and (3) provide a course especially adapted to principals and superintendents.

That the amount of writing on physical education subjects should form such a very small percentage of the total amount of material published in education magazines is very likely due to one of two causes. Either those interested in this program are failing to realize the importance of following up the beginning made, or the magazines studied do not consider this part of the program important enough to be given space. The fact that most educators, superintendents, and principals feel that physical education should be an intrinsic part of the educational program argues against the latter. It seems high time for those in the physical education profession to take more interest in putting the program before people, not only to students, but to the school board, the superintendent, the principal, and the parents as well.

Weighted Strength Tests for the Prediction of Athletic Ability in High School Girls

By Theresa W. Anderson,
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PROBLEM

In THIS study the investigator has endeavored to determine: (1) to what extent individual athletic performance in girls is dependent upon strength; (2) what battery of strength tests would best test this ability; (3) how that battery should be weighted; (4) how the Physical Fitness Index correlates with athletic performance; (5) whether or not a weighted Physical Fitness Index would improve this prediction.

REVIEW OF LITERATURE

Frederick Rand Rogers states that the Strength Index and athletic ability with high school boys have a correlation of .76.[1] He presents no similar evidence for girls.

C. H. McCloy states that arm strength is the most important factor in the prediction of either general motor ability or track and field ability for boys.[2]

Gus Rump states that:

1. The multiple correlation of total strength (weighted) with general motor ability is relatively low (R—.553).[3]
2. The multiple correlation of the best weighted combination of grips, thigh flexor strength, chins and dips, with general motor ability is almost as high (R—.530).[3]
3. Strength alone is not enough to predict general motor ability, with any large degree of accuracy.[3]

Victor C. Dunder comes to much the same conclusions as Rump, except that he did not use the thigh flexor strength.[4]

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[1] Frederick Rand Rogers, *Tests and Measurement Programs in the Redirection of Physical Education*, New York: Bureau of Publications, Teachers College, Columbia University, 1927.

[2] C. H. McCloy, "Apparent Importance of Arm Strength in Athletics," Research Quarterly, V: 1 (March, 1934).

[3] Gus Rump, The Relative Contribution of Arm, Back, Abdominal, and Leg Strength, to the General Athletic Ability of High School Boys, Masters Thesis, State University of Iowa, 1931.

[4] Victor C. Dunder, "A Multiple Strength Index of General Motor Ability," Research Quarterly, V: 1 (March, 1934).

SET-UP OF STUDY

In collecting these data, the investigator used Rogers' strength tests, with the following exceptions:

1. Omission of lung capacity test since it was found by McCloy to be of little significance with boys. He found in all Rogers' events weighted, using lung capacity, a correlation of .7224. Without lung capacity the correlation was .7193.[5] These correlations were with athletic ability.

2. Addition of measurements of thigh flexor strength, push and pull for the purpose of determining whether these tests would add anything. To the investigator's knowledge, nothing has been published on the value of these tests for girls.

3. McCloy's method of administering and scoring pull-ups and push-ups instead of Rogers', since it was found by McCloy to more accurately represent actual strength. The correlation with actual strength is still low, but higher than in Rogers' method.

Since track and field events have been found to be fairly good indicators of athletic ability, the following events were used: (1) forty-yard dash; (2) standing broad jump; (3) running high jump; (4) basketball throw.

These events were scored according to McCloy's scoring tables for girls,[6] a certain number of points being given for various levels of accomplishment. The sum of these points was computed for each girl and is designated as the *total points* in athletic score.

SUBJECTS

The tests were given to three hundred girls, grades of ten and eleven, in North High School, Des Moines, Iowa. All were students of the investigator. Only students taking the regular physical education work were used. Those crippled in any way were eliminated.

ADMINISTRATION OF TESTS

The tests were administered according to Rogers' directions, with the following exceptions:

1. Pull-ups were administered according to Rogers' directions with the exception that the height of the middle of the bar was at the level of the xiphoid cartilage. The chinning and dipping for the girls was scored by means of McCloy's formulae:

Chinning strength or pull-ups equal .67 (weight) plus 1.2 (number of chins) plus 52.

Dipping strength or push-ups equal .78 (weight) plus 1.1 (number of dips) plus 74.

2. Measure of thigh flexor strength was determined by having subject lie on back with thighs flexed on abdomen and her shoulders held down. A strap was placed around the knees, one and one-half inches above the patella. To the strap, was attached a dynamometer which was also attached to a handle. The administrator of the test pulled on the strap until the subject could no longer keep her knees flexed beyond a right angle. The amount of resistance which the subject was able to exert, was recorded on the dial.

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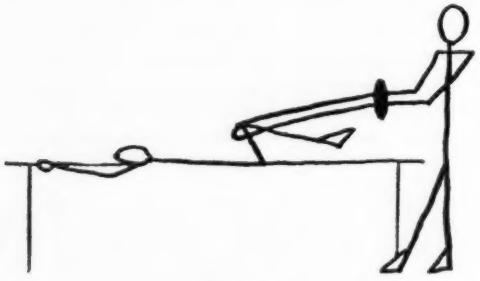
[5] C. H. McCloy, *Op. Cit.*

[6] C. H. McCloy, *Scoring Tables for Girls*, published privately.

3. Measure of amount of push was determined by having subject hold the apparatus for measuring in front of the lower chest.[7] This consisted of two handles, with a grip dynamometer between. Subject was instructed to push handles together as much as possible.

4. Measure of amount of pull was determined by means of the same apparatus. The subject was instructed to pull the handles as far apart as possible.



RESULTS

Means and standard deviations were computed for each strength test and for the total points on track and field athletic score (Table I).

TABLE I

MEANS AND STANDARD DEVIATIONS

Variable	*Mean*	*S. D.*
Total Points on Athletic Score	1249.63	248.00
Grips	131.90	23.60
Pull-ups	145.89	13.80
Dips	168.40	11.40
Thigh Flexors	68.46	16.55
Weight	113.11	13.16
Push	43.24	12.72
Pull	48.03	11.62
Leg Lift	231.20	58.20
Back Lift	190.80	13.86

Zero order correlations were computed, correlating each strength event and total points of track and field, which represents athletic ability, with each other and were found to be mostly low (Table II).

The Doolittle method was used for computing the multiple regressions of strengths to predict total points. By this method the last variable can be dropped successively without entirely recomputing the entire group of regression coefficients each time.

The table of multiple regressions and multiple correlations was computed twice, numbering the variables as in Tables III and IV.

[7] The apparatus was the Narragansett Machine Company's grip dynamometer with the push and pull attachment. The same equipment with a strap through one handle was used to measure thigh flexor strength.

TABLE II

INTERCORRELATIONS

	Grips	Pull-ups	Dips	Thigh Flexors	Push	Pull	Weight	Leg Lift	Back Lift
Total Points on Track and Field Athletic Score	.234	.081	.173	.414	.395	.264	.075	.344	.238
Grips		.304	.348	.293	.358	.448	.326	.207	.808
Pull-ups			.605	.039	.212	.282	.577	.258	.362
Dips				.424	.286	.372	.827	.314	.487
Thigh Flexors					.354	.377	.229	.374	.406
Push						.638	.294	.291	.430
Pull							.420	.368	.446
Weight								.224	.389
Leg Lift									.384

TABLE III

REGRESSION VALUES AND MULTIPLE CORRELATIONS
(First Combination)

1. Grips	Beta 1	.2389	.2440	.2271	.2474	.1581	.2090	.2039	.2307
2. Pull-ups	Beta 2	.0859	—.0668	—.0658	—.0723	—.0402	—.0388	—.0654	.0109
3. Dips	Beta 3	.0172	.2572	.2617	.2324	.2866	.3084	.1396	
4. Weight	Beta 4	—.1436	—.2442	—.2602	—.1896	—.2175	—.2257		
5. Back lift	Beta 5	—.2422	—.2015	—.1942	—.0974	.0699			
6. Leg lift	Beta 6	.2198	.2785	.2673	.3183				
7. Push	Beta 7	.3262	.3637	.3352					
8. Pull	Beta 8	—.1098	—.0606						
9. Thigh flexors	Beta 9	.3150							
Ro.1.2...n		.5507	.5034	.5016	.4054	.2892	.2867	.2580	.2340

TABLE IV

SAME AS ABOVE
(Second Combination)

1. Grips	Beta 1	.2389	.0719	.0631	.0830	.1128	.2090	.2039	.2307
2. Pull-ups	Beta 2	.0859	.0779	.1239	.0218	.1642	—.0388	—.0654	.0109
3. Dips	Beta 3	.0172	—.0298	—.0171	—.0060	—.0740	—.3084	.1396	
4. Weights	Beta 4	—.1436	—.1260	—.1508	—.1674	—.0962	—.2257		
5. Thigh flexors	Beta 5	.3150	.2989	.3550	.3449	.4408			
6. Push	Beta 6	.3262	.2979	.3036	.2794				
7. Pull	Beta 7	—.1098	.0928	—.0540					
8. Leg lift	Beta 8	.2198	.1824						
9. Back lift	Beta 9	—.2422							
Ro.1...n		.5507	.5368	.5130	.5107	.4496	.2867	.2580	.2340

Two other groupings which have nearly as high a correlation as the whole battery of tests are:

Thigh flexors	Beta 1	.3043	.3134
Push	Beta 2	.2700	.2840
Grips	Beta 3	.0482	
Ro.1...n		.4939	.4919

This battery has the advantage that it can be administered with only the grip dynamometer and the push and pull attachment and constitutes a "short form."

Thigh flexors	Beta 1	.2616	.2533	.2597	.3134
Push	Beta 2	.2618	.2421	.2526	.2840
Leg lift	Beta 3	.1842	.1710	.1733	
Grips	Beta 4	.0662	.0377		
Weight	Beta 5	—.1247			
Ro.1...n		.5303	.5178	.5167	.4919

Had we used the whole battery of tests we should have obtained a slightly higher correlation, .5507, but the investigator finds that 4 tests are practically as good since they give a correlation nearly as high, .5270. The 4 tests which give this correlation of .5270 are thigh flexors, push, leg lift, and weight. Grips might be added because of interest to the girls.

Thigh flexors	Beta 1	.2714
Push	Beta 2	.2771
Leg lift	Beta 3	.1866
Weight	Beta 4	—.1106
Ro.1...n		.5270

The following multiple regression equations were computed to show the best weighting of the test items (in deviation form).

Xo = Total Points of track and field scores

$Xo = 3.796(\text{thigh flexors}) + 4.720(\text{push}) + .728(\text{leg lift}) + .397(\text{grip})$
$Xo = 4.560(\text{thigh flexors}) + 5.264(\text{push}) + .503(\text{grip})$
$Xo = 3.920(\text{thigh flexors}) + 5.104(\text{push}) + .785(\text{leg lift}) + .696(\text{grip}) - 2.350(\text{weight})$
$Xo = 3.892(\text{thigh flexors}) + 4.925(\text{push}) + .738(\text{leg lift})$
$Xo = 4.067(\text{thigh flexors}) + 5.402(\text{push}) + .795(\text{leg lift}) - 2.080(\text{weight})$

These regression equations were then simplified into approximation forms for easy administration:

$Xo = 6(\text{thigh flexors}) + 7(\text{push}) + 1(\text{leg lift}) + 5(\text{grip})$
$Xo = 9(\text{thigh flexors}) + 10(\text{push}) + 1(\text{grip})$
$Xo = 5(\text{thigh flexors}) + 7(\text{push}) + 1(\text{leg lift}) + 1(\text{grip}) - 3(\text{weight})$
$Xo = 5(\text{thigh flexors}) + 7(\text{push}) + 1(\text{leg lift})$
$Xo = 5(\text{thigh flexors}) + 7(\text{push}) + 1(\text{leg lift}) - 2.5(\text{weight})$

The constants in the regression equations have been omitted in each case, as they do not add to the relative position of the individual's strength tests as compared with others in a P. F. I. type of index.

For comparison, the correlation of the unweighted strength index with total points was computed, the resulting correlation coefficient being .460.

THE PHYSICAL FITNESS INDEX

Two experiments were made with the Physical Fitness Index as a predictor of athletic ability. In the first, the Physical Fitness Index was computed in the usual manner, namely, the actual Strength Index was divided by the normal index for age and weight. The correlation with total points of track and field was .440.

In the second experiment, a weighted Physical Fitness Index was de-

vised. This was derived by first computing the multiple regression equation for the variables used (using the same ones as those used in the short form discussed above) with weight as one of the variables. The weightings without the weight variable were then used and simplified into a simpler approximation form, and the index computed by this means, norms derived, and the Physical Fitness Index (weighted) computed from this equation. The weightings used were:

$$5(\text{thigh flexors}) + 7(\text{push}) + 1(\text{leg lift}).$$

The multiple correlation was .489, or slightly less than the correlation with the weighted Strength Index. It would seem therefore that so far as predicting individual athletic ability is concerned, that the Physical Fitness Index offers no advantages over the Weighted Strength Index.

CORRELATIONS OF UNWEIGHTED STRENGTH INDEX WITH EACH STRENGTH VARIABLE

Each variable used in the study was correlated with the unweighted strength index. The resulting zero-order correlations, in order of size, were as follows:

Strength Variables	*Unweighted Strength Index*
Leg lift	.820
Back lift	.815
Grips	.689
Pull	.619
Weight	.608
Dips	.600
Thigh flexors	.587
Push	.524
Pull-ups	.498

STANDARDS

For the convenience of those wishing to use the weighted Strength Index for purposes of classification, without going to the trouble of computing a Physical Fitness Index, we have appended a T-score of these strengths indices, computed by the formula:

$$5(\text{thigh flexors}) + 7(\text{push}) + 1(\text{leg lift}).$$

Strength	*"T"*	*Strength*	*"T"*
1650	92	900	54
1600	88	850	51
1550	84	800	48
1500	80	750	45
1450	77	700	42
1400	74	650	39
1350	72	600	36
1300	70	550	33
1250	68	500	30
1200	66	450	26
1150	64	400	22
1100	62	350	18
1050	60	300	15
1000	58	250	12
950	56	200	9

SUMMARY AND CONCLUSIONS

A number of strength test items have been tried for the purpose of determining the best combination for the prediction of "athletic ability" as determined from a battery of track and field athletic events—which has, in turn, been found by others to be a relatively good indicator of general athletic ability. A short weighted battery has been suggested as a "best" battery of strength tests for this purpose, and this battery is almost as good for predicting this athletic ability as is the longer battery.

The multiple correlation with athletic ability is only .55 with the longest battery tried. It would seem that:

1. Strength as tested by this test or other strength tests in use is not the sole factor in the athletic ability of girls. It is probable that this correlation would be much raised if corrected for attenuation, but this would not represent the usual conditions obtaining in testing situations, hence it has not been done.

2. It is probable, from the writer's subjective observation, that there are other factors of build, relative fatness, and other elements in the situation that influence these results.

3. It is also probable that the omission of tests for speed, which might be tested by the Sargent jump, for example, contributed to this relatively low correlation.

4. It is also probable that the girls tested are less homogeneous in their ability or willingness to give to the uttermost in the strength testing or in the athletic events, as compared with a similar group of boys.

5. It is also probable that the element of relative skill in the track and field events also contributed to this smaller correlation. These present problems for other investigations.

The major contribution of this study is to show that even with the best combination and weighting of strength tests, neither the "total strength" nor the Physical Fitness Index is a very valid predictor of the "athletic ability" of the girls tested. It does not at all demonstrate that strength is not a very valuable element in the total motor ability of high school girls. In view, however, of the widespread reliance on strength tests as predicators of such abilities for the purpose of classifications of girls for gymnasium activities, it would seem that there should be less confidence placed in the efficacy of strength tests for this purpose, and a continued endeavor to make further contributions to this problem with other tests, at least until more experimental evidence has been adduced to support the validity of strength tests for this purpose.

Training for Flexible Posture and Relaxation Movements*

By R. H. Stetson and G. C. Throner
Oberlin College

THE PERSON at work or at play is not a framework clamped and bolted in position supporting the moving levers of the limbs. However sedentary or stationary an activity may be the posture is actually a system of supporting movements. The bony framework is a group of yielding, shifting levers. The bony framework meets the varying strains of the moving limbs by the changing contractions of

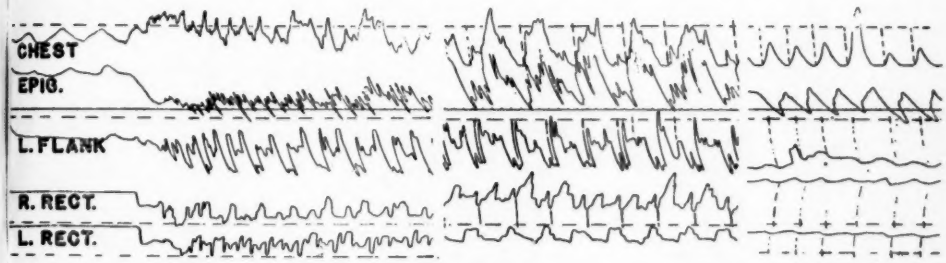


Figure 1.—Man Running on a Special Tread-Mill: Showing the Use of the Same Trunk Muscles in the Movements of Breathing and of Running.

Section I—As the man begins to run.
Section II—Some minutes later during heavy exertion.
Section III—At rest, immediately on stopping.

As labeled, the lines of pneumatic record give:

Chest: The movements of the chest in breathing.

Epig.: The movements of the epigastrium, the upper part of the rectus as affected by the diaphragm.

L. Flank: The movements of the flank, the lateral abdominal muscles.

R. Rect.: The right column of the rectus abdominis.

L. Rect.: The left column of the rectus abdominis.

I. As the man stands in repose before running, the breathing shows in the chest and in the epigastrium; the lower rectus and the lateral abdominal muscles are not involved. As he begins to run, the epigastric part of the rectus tightens, but soon shows the breathing movements; the lower rectus and the lateral abdominal muscles are not involved.

II. In heavy exertion, the epigastric region shows extensive breathing movements; but the lower rectus and the lateral muscles have to do mainly with the movements of running.

III. As he stands still, after continued running, *all* the muscle groups participate in the heavy breathing movements.

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* A paper presented before the Therapeutic Section of the American Physical Education Association Convention, April, 1935, at Pittsburgh, Pa.

the large muscles. The large muscles bind the supporting members together and shift their position with the varying strains of the moving limbs.

It would seem natural to say that the good runner holds the trunk rigid, shoulders driving a straight line through the air, pelvis meeting the repercussions of the pounding legs. But the trunk of the good runner cannot be rigidly fixated. The muscles change with every stride, to meet the repercussion and to adjust the movement at the hip. And lying, sitting, standing, running, the same muscles which maintain the changing "posture" must accommodate themselves to the breathing; indeed the very muscles which maintain the changing posture must have some part in the breathing movements.

It is probable that pain in the side in running is a posture fatigue, due to bad co-ordination between the breathing and the running movements.

Balance and poise are usually dynamic. It is the momentum of a moving mass which meets the rebound of the stroke in the runner's step or the swimmer's and the golfer's stroke. Ball pitching is a striking

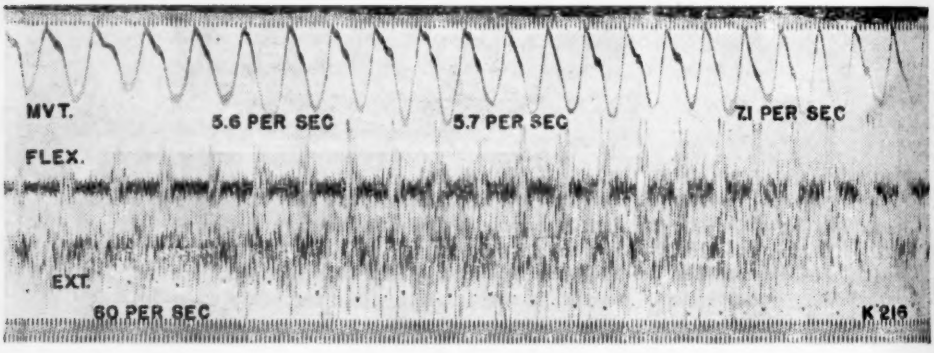

FIGURE 2.—Rapid Tapping of Forearm and Hand: Skilled Piano Player.

Mvt.: Kymograph record. The beating of the hand and forearm on table. Beat-strokes to table are UP on the record. 4—7.5 per sec.

Flex.: Action-current record shows the momentary contractions of the flexor muscles, with complete relaxation between. Each group of coarser, wider oscillations represents a single, sudden contraction and relaxation of the muscles. At maximum speed there is some continuing contraction—although the subject was a skilled pianist; that is the type of continued contraction and tension which tends to infect the postural movements.

Ext.: Extensor muscles which are slightly contracted continuously to support the tapping arm. The action current pulses which raise the arm show as zones of coarser and wider oscillation. At the maximum rate the continuous contraction is pronounced.

Shows the sudden *pulses followed by complete relaxation* in the typical ballistic movement. Shows that even with a skilled performer, there tends to be some continuous contraction, some tightness of movement at the maximum rate. This is likely to spread to the supporting musculature.

case of dynamic balance. The "posture" in these cases is a matter of bringing momentum to bear at the right time and place. The heavy contractions of the trunk muscles for the limb strokes are momentary; the continuing tensions are as light as possible.

But is one to say that standing at a desk or bench in the laboratory and shop, that sitting to write with a pen, or to type, or to play the piano, involve constant changes of the trunk muscles? What about the ordinary standing or sitting position? Some learn to work all their lives at the bench, to write or type by the day, and to practice at the piano hours on end and without any untoward results. And others develop spinal curvatures, aching shoulders, writer's cramp which is often in the upper trunk, and piano arm which is nowadays nearly always in the shoulder girdle.

For such postures the essential thing is a light and varying contraction of muscles which make a varying system of trunk movements.

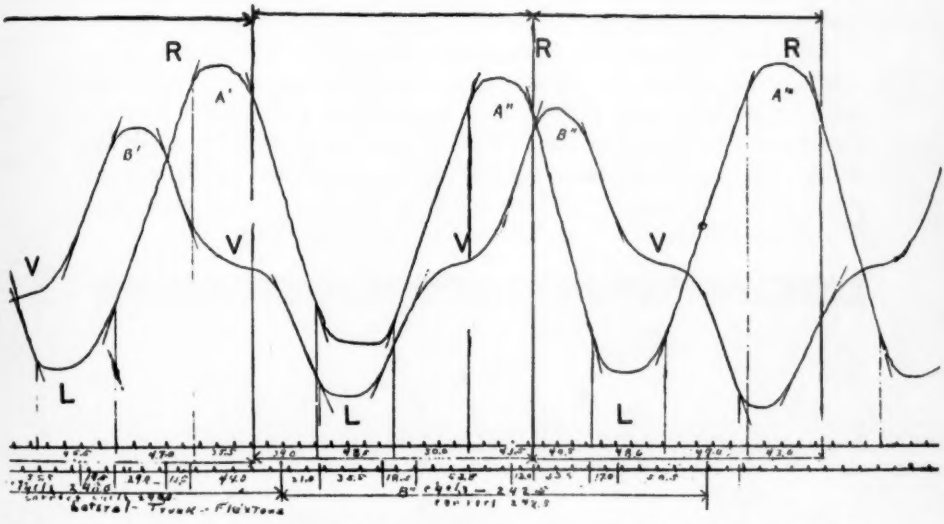

FIGURE 3.—Kymograph Tracings of the Movements of Lateral-Trunk Exercise.

In the form marked *A*, *A'*, *A"*, the trunk swings with a ballistic movement from the extreme right, *R*, to the extreme left, *L*.

In the form marked *B*, *B'*, *B"*, the trunk swings from the extreme right, *R*, with a ballistic movement to the vertical position of attention, *V*, and from this vertical position to the extreme left, *L*.

The ballistic strokes are apparent in the right line character of the curves, both in the *A* movements and in the *B* movements.

But the supposed fixation of the vertical position of attention *does not prove to be a fixation;* instead it is a *moving posture,* in reality a slow adjusting movement for the next trunk movement. Instead of a rigid fixation, one has a flexible, moving posture. Note that the shoulders of the curves *B* are not square, and the line horizontal as it must be for a rigid fixation.

The trunk must yield toward the working head and hands. Even the limited movements of typing and of writing should involve a constant change of the trunk position; there should be so little tension that the trunk can shift easily, that the support of the head can change, that the shoulder pivot can move with the work. At the piano the upper arm, and the shoulder, and the trunk must follow the passage; the supporting movements must change constantly, and the muscle contractions be concentrated where they are needed. Standing need not be a rigid business; the person moves constantly with the weight now on one foot, now on the other and now on both; if it is possible he moves about. He accommodates his changing posture to the turn of the head and eyes, to any movement made with the hand. You cannot say that he stands well or ill, until you know what he is doing as he stands; and certainly good stance is never a fixed posture. With the proper type of supporting posture the bad contractures of spinal curvature, writer's cramp, typist's back, and piano arm do not appear. It is the false rigidity, the continuous overstrain on opposing muscles which does the damage.

Poise as a momentary preparation for some sudden action, as a readiness to do any and all things, is sometimes essential. Your man must be ready for any and all lines of attack in fencing and boxing; the stance at bat and in the football line-up must get him ready for action but any unnecessary contraction is wasted and spoils a good start. Everything must lead to dynamic balance as the man goes into action for which this preliminary poise is established.

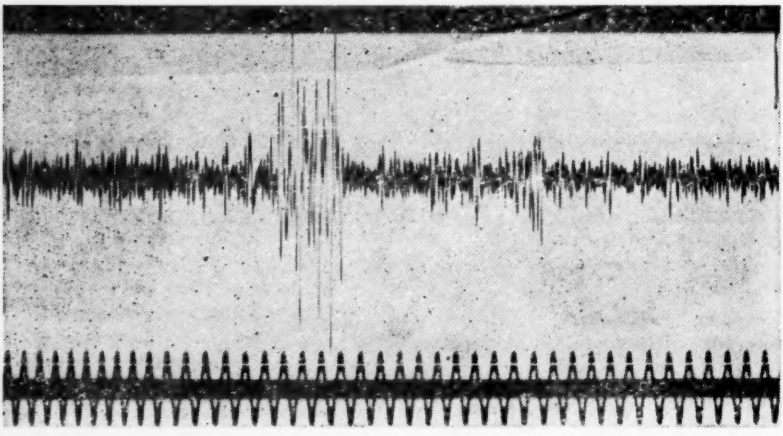

FIGURE 4.—A Single Isolated Motor Unit Which Produced a Ballistic Movement.

The action-current line shows the slight series of electrical disturbance due to the changing conditions of the muscle at rest. The motor unit itself is marked by a coarsening of the oscillations and a sharp difference in amplitudes.

The time line gives 60 per sec.

The momentary poise, and the rapidly shifting posture which brings the mass and momentum where it is needed, must all be behind the rapid movement of the limbs. The system of movements of the trunk and other framework supports the rapid strokes of pitching baseball, tennis, batting, running. The posture maintains the pivots and resists the strains of the sudden contractions for the movements of the arms and legs. And sometimes the trunk itself is thrown with the limb.

A good fast movement must be a relaxed movement. We speak of a good movement as a free movement. Wherein is the relaxation of a rapid movement? In what sense can a movement be *loose* and *free*?

The ballistic movement swings round the pivot joint; the driving muscles contract suddenly and relax, and the limb swings free by its

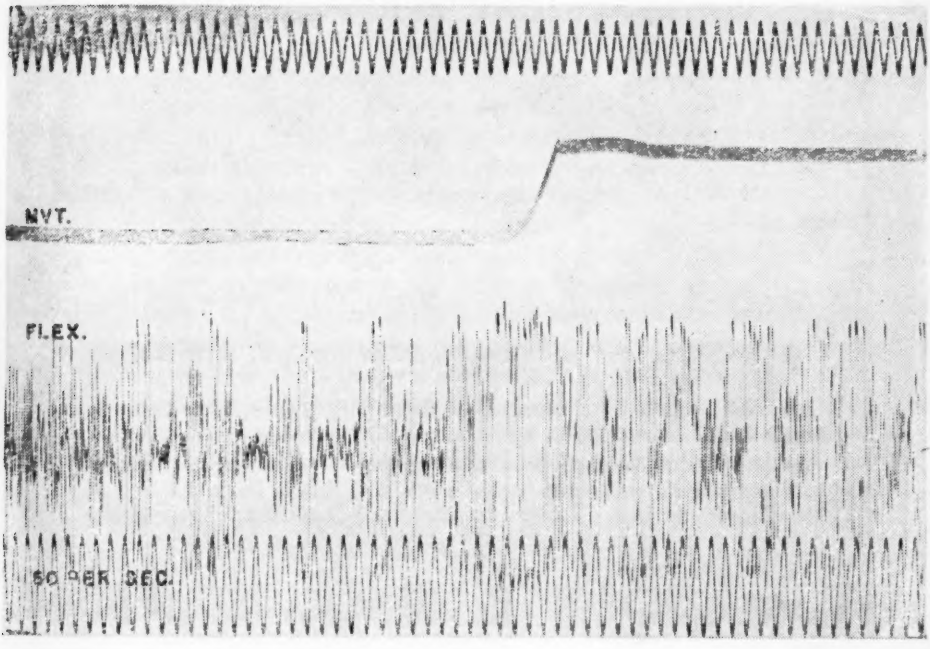

FIGURE 5.—Movement of the Hand (at Wrist) Against the Continuous Tension of a Spring.

Mvt.: Shows the sudden movement—it is ballistic, but of the tight form because working against the continuous tension of spring. The movement is very rapid, and the position is retained after the movement.

Flex.: Continuous contracting, showing the tremors of the tense muscle, both before and after the movement. The action current pulse for the movements shows as a zone of coarser contraction, but there is little increase in amplitude.

Shows or suggests over-exertion and early fatigue when muscles function under tension without rest and relaxation between movements.

Time lines, 60 per sec.

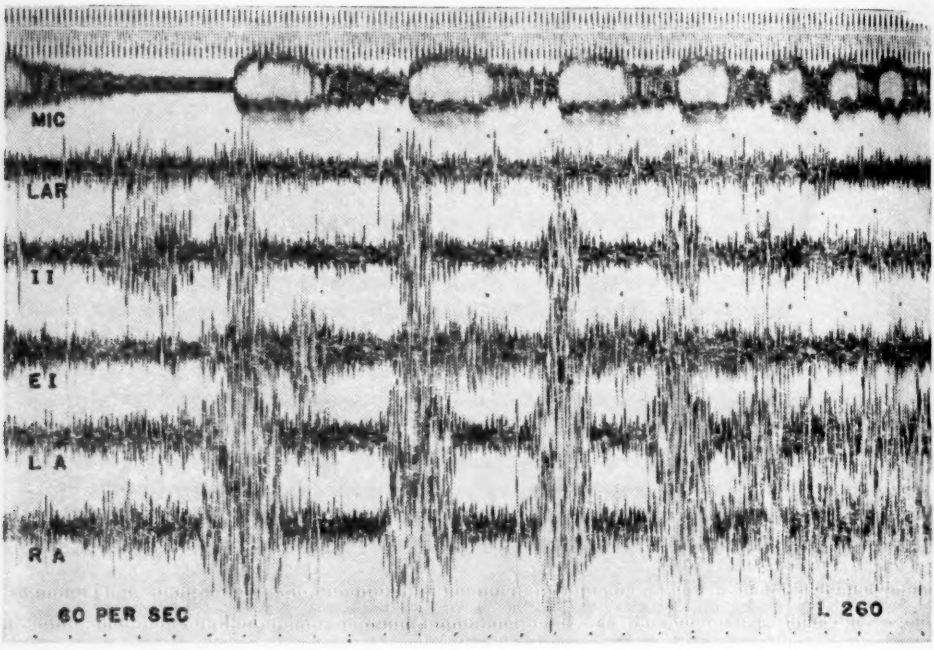

FIGURE 6.—Fixating of the Abdominal Muscles in the Course of Very Rapid Utterance.

Mic: Microphone showing the syllables spoken, pup, pup, faster and faster up to ca. 6.5 per second.

L: Larynx. Shows the contractions of the intrinsic muscles of the larynx for each syllable.

II: Internal intercostals; muscles between the ribs—most prominent in the back. Shows rapid ballistic action current pulses with the beginning of each syllable. Synchronous with the abdominal muscles, which also contract for the expiratory movement of each syllable, until the rate compels abdominal fixation.

EI: External intercostals; muscles between the ribs—most prominent at the front. Leakage at the beginning of each syllable—from the abdominal muscles in vicinity. Real action at the end of the syllable, to stop the ballistic pulse of the syllable.

LA: Lateral muscles of abdomen; oblique and transverse muscles of the abdomen, as a group. Contract with the rectus abdominis, but they clearly *follow* the lead of the rectus.

RA: Rectus abdominis: Leads the syllable movement until the rate is so rapid that the abdominal muscles fixate. At *ca. 4 per sec.* the abdominal muscle can *no longer make the pulse for each syllable* and *they fixate to support the movements of the rib-cage which take over the speech movements.* The fixation, however, is light, not nearly as powerful as the contractions of the preceding strokes. Shows muscle movements have rates or rhythms for most economical performance and with minimum of fatigue.

Time lines, 60 per sec.

own momentum through the greater part of the excursion. It is actually a ballistic, a *thrown* movement.

During the "loose," "free" movement, then, the pivot joint of the movement is fixated, but the muscle group which drives the stroke and the muscle group which is to return the limb for the next stroke are both of them completely relaxed during the stroke.

Complete relaxation appears then during the stroke itself. And there is no opposition of the antagonistic muscles when the sudden contraction sets off the stroke. In a free ballistic movement which may be repeated at high speed the muscles have a chance to relax and to rest during the very course of the stroke. And there is no energy lost in the contraction of one muscle set against another. It is the most economical and the least fatiguing of the forms of movement. All rapid movements which are well-done, running, swimming, dancing, tennis and golf and batting strokes, all the movements of the ordinary games and sports and of many of the occupations, are ballistic and free.

All rapid movements involve this sudden pulse of the driving muscles, but there is a bad form of rapid movement in which there is contraction throughout and the muscles waste power working against each other. Such a tight, rigid movement uses unnecessary energy, and leads to rapid fatigue of the limb.

And the tight movement of the limb, in which the driving pulse has to work against the resistance of rigid muscles has further and serious effects. The false rigidity infects the supporting movements; the posture also becomes rigid. Writer's cramp, and typist's back, and piano arm, the whole series of posture fatigues, and much of the exhaustion from ordinary work and play as many people do it, is due to a false rigidity in the rapid, precise limb movements which infects the supporting movements, making a rigid posture which hampers the movements and leads to fatigue; and if the condition is long continued the irritation sets up a reflex, the extreme contraction becomes chronic and the result is a posture fatigue; this may become at last a definite "occupation neurosis."

In teaching relaxation one must cultivate the loose blow, in which no muscle contracts after the limb is under way. Evidently slow practice alone will not solve the problem. There may be long waits between strokes, but the blow itself, with its complete relaxation, must be sudden and the movement is swift. Slow practice may teach the path of the movement and the essential bearings. A slow movement in which both muscle-groups are contracting continuously is quite unlike the necessary ballistic movement. Practice of the free-ballistic movement must always be fast enough to insure the nature of the movement.

A clever and experienced performer can slow down the whole serial process, as in kips and mat-work, so that the onlooker can see the points at which the ballistic movements explode into action.

A very rapid rate of repeated movement presents difficulties. Probably the best type of physical education which is done today is the teaching of piano playing. The rapid alternation is likely to lead to reciprocal tension, and in the end to overlapping and interfering contractions. To reach the maximum rate of repetition, one must keep the loose type of movement and the light and elastic posture. If rigidity and tight movements have been developed the process must be slowed down to the rate at which loose ballistic movements are possible. Often it is better to make a complete change of the general posture by raising or lowering the seat at piano or typewriter, by shifting the stance at the baseball plate, by changing the length of stride of the runner. Then the rate may be increased without falling into the unlucky rigidity which the subject learned with his original form.

Relaxation involves also a light, flexible posture which shifts with the movement and uses the momentum of the moving mass rather than heavy rigidity wherever possible. The posture must go with the movement, be a part of it, and meet the rebound of the heavy stroke with a moving, yielding mass; posture must be taught as sets of changing and supporting movements for a particular series of limb strokes. Change and relaxation must occur wherever possible; the changing and adjusting posture is the true posture.

Problems in the Placing of Practice Teachers

By Elizabeth Abbott
Department of Physical Education for Women, Northwestern University

When I was asked to present a paper to this section* on some phase of teacher training, I naturally turned to a problem over which I have been much concerned—that of placing practice teachers in situations where they would get as full an experience, with as many phases of teaching as possible.

As we all know, directing a class which is already organized, in some form of activity which has been previously decided upon, is the smallest part of teaching. As a new teacher starts out with her first position she finds a multitude of obstacles—some petty details, some larger considerations—which must be hurdled before class activity can move smoothly and purposefully. These things she or he has heard about in theory courses perhaps, but has never given the importance they are apt to assume in the first job. Directing the activity of a class in which one has no responsibility for outcomes is quite a different task from directing one in which the teacher is going to be obliged to give grades for "gym" at the end of the term or semester. We want our major students to become teachers who will be conscious of the individual differences and needs of their pupils and will try to organize their classes so that these differences and needs may, in some measure, be taken into consideration; who will select activities suitable to the age group with a definite end in mind; who will plan through a semester or a year so that these ends may be accomplished; who are not afraid to try new and different methods of accomplishing what seems desirable; and who will feel that their work is not complete unless some check on what actually has been accomplished has been made. We want our students also to have some chance at solving these problems in actual situations before we send them out to teach in schools where they will no longer be under supervision.

Practice teaching is an exceedingly valuable experience. It has been rated as the most valuable course in their training by teachers in service. It is one of the requirements for certification in a number of states. The extent of its value depends on the conditions under which the practice teaching takes place. In a survey made by the Commonwealth

* A paper presented before the Teacher-Training Section at the Mid-West District Association Convention in Milwaukee, April, 1935.

Teacher-Training Study, some twenty-five experiences were found important for practice teachers. This list was compiled from statements by superintendents of schools and supervisors of practice teaching. Dr. Baugher, in his study of practice teaching, made at Teachers College, Columbia University, corroborates this list. The first five, those most frequently mentioned, were:

1. Planning, selection, and organization of material
2. Teaching pupils how to improve skills and abilities in method of study.
3. Planning methods of instruction.
4. Diagnosing pupils' needs and difficulties.
5. Planning methods of developing interest.

While these were suggested for academic teachers, they are fully as important for teachers of physical education.

In considering our situation at Northwestern University, I did not feel that we checked up very well on this list. We have no experimental school, or other school connected in any way with the University, in which we can place our practice teachers, and so we are dependent on whatever school will take our students. Recreational classes in settlement houses and "Y's" did not seem to meet the need. The students were in full charge of the class, it is true, but there was no experienced teacher to give them any help or guidance, so that any check on the practice teacher, help with discipline, and so forth, had to come from the relatively infrequent visits of the supervisor. Moreover, in recreational classes, the teacher must keep the interest and hold the group often at the expense of developing further skills or doing any progressive teaching. Our sophomores and juniors may take classes in settlement houses "for experience" but it is not called practice teaching.

At one time our practice teachers were placed in elementary schools to carry on the physical education work between the visits of the regular supervisor. This led to a great deal of confusion both for our students and for the pupils in the public schools. The public school supervisor planned material for the elementary grades which was presented at a weekly or bi-weekly visit. The room teachers were present, saw the lesson, and were expected to carry on until the next visit of the supervisor. The student teachers took the place of the room teacher and so followed the materials previously taught, but not having seen the first presentation of the work often varied in details, which confused the children. There was no chance for planning and trying out new materials and methods. The students had contact with the children, which was better than nothing, but they did not actually manage the class as the room teacher was always present to quell the least sign of disturbance. Our department and the public school physical education supervisor both decided that some other place would be better for our practice teaching. Although we are trying to gain for our major students maxi-

mum experience, we do not wish to do so at the expense of the pupils in the classes or of the regular physical education program.

When we sent our students to the high school, they were given the after-school intramural work. The high school program is an excellent one in which skills are taught in the required classes. The after-school program is largely one of the practice of already acquired skills and of tournaments. Our students had valuable practice refereeing games, but none in planning lessons and teaching skills. The regular high school staff hesitated to allow inexperienced teachers to have charge of their regular classes. At present we are not using the high school at all, but are sending our students into the intermediate schools.

Since we have to use whatever places are available, the situation is far from ideal. There is, for instance, the teacher who is "crabby"—who expects instant and noiseless obedience from her classes and demands the same of the student teacher, and who always stands on the side lines and criticizes so destructively on details that the poor student teacher loses all enthusiasm and does a very bad job of teaching from sheer nervousness. There is the teacher who welcomes the student teacher because it gives her a chance to have a rest, to get caught up on office work, and who apparently does little to help, advise, or encourage the student teacher. There is the teacher who sets up a program which is a fine example of things that we tell students they must *never* do, and the student teacher must follow it. We ask our students to make daily lesson plans. In some cases they can follow them, in others the critic teacher tells them what to do. It is rather discouraging to the student to spend time planning when we all know that probably the plans will not be carried out. We ask the students to make unit plans, although they may or may not be able to carry them out. Not everything about our situation is discouraging, of course, however much I may have been emphasizing the unfortunate angles. Since I have started on this study, we have made a contact with one of our high schools that promises to be most helpful and profitable.

We did not think that our experiences at Northwestern University were particularly unusual. It seemed to us that our troubles originated because we had to place students in available situations, near at hand because of the expense of car fare, and so had little choice of critic teachers. Then we had no influence over the critic teacher, once our students were placed, since the students were there on sufferance.

It is always hard to start the study of a problem with a preconceived idea, but this is just what we did. We formulated a brief questionnaire which we thought might elucidate the questions: Is our situation unique? Is it because we cannot choose our critic teachers that we have this problem? Would payment of the critic teacher help toward a solution? One of the professors in the School of Education very kindly edited the questions for us. The brevity of the completed list may

account for the excellent return, fifty-three out of the one hundred we sent out, but it also accounts for my dilemma in attempting to interpret the results, although I garnered many ideas from reading the returns.

In the fifty-three returned questionnaires we found replies from all types of schools: colleges and universities with a major in physical education, teachers' colleges with a major, and a few normal schools of physical education. Both men and women were represented.

In giving you the results from this study, I am trying to refrain from the use of figures. I have them, however, for reference.

We first asked what types of classes were used for practice teaching. While a wide variety of classes were mentioned, such as settlement houses, "Y's," and clubs, no one institution depended on these entirely. The most frequently used classes were in public high schools (thirty-seven), public elementary schools (thirty), and experimental schools (twenty). Thirty-three used more than one type of class—I neglected to find out whether each student had a varied experience—and only eight used experimental schools alone.

We felt that the institutions having experimental schools in which to place their student teachers had a slightly different problem from those without, even though they used the public schools also. Presumably they had more influence over the selection of classes, critic teachers, and the activities of their student teachers. The rest of the questions, therefore, were checked first considering all replies, and then considering only those without experimental schools.

While our second question may not have had much to do with the subject at hand, we were nevertheless interested in finding out something about the prerequisites for the opportunity to practice teaching. The most frequent requirement was the completion of courses in both groups of schools. Scholarship came next. This of course is involved in the completion of courses, but twenty-six schools mentioned it specifically, many indicating a scholarship average above that which was required for graduation. Intelligence was next in order. Then came a scattering of requirements such as character, leadership, personality, personal appearance, and skill. More of the second group of schools (those without experimental schools) had requirements beyond that of the completion of courses.

The next question asked was "Is the critic teacher selected?" Here I think there was a confusion of terms. By "critic teacher" we meant the teacher who would have the class in physical education if the student or practice teacher were not there. The person on the college faculty who has charge of placing the practice teachers, with whom they have their conferences, and who visits the classes occasionally, we refer to as the "supervisor." The critic teacher, being responsible for the class, we expect will be there practically all the time the practice teacher is in charge of the class, and should be the person to give immediate

advice, help, and criticism. From the answers, some misunderstanding was evident. However, a large number indicated that they *did* select the critic teacher: eighteen out of thirty-three of the non-experimental school group and fifteen out of twenty of the group with experimental schools. Eight used whoever was available, six of these being without experimental schools; four had no critic teacher; and seven gave varying responses such as "It varies with the type of school," "Partially," "Usually." I wish we had inquired how it was possible for so many to select the critic teachers. Do they have few practice teachers?—or a large number of physical education teachers in the vicinity?—or are their students richer than ours so that they may be sent farther afield? If we ever pursue this study further, questions will certainly be added here.

We asked whether or not the critic teachers or the institutions were paid for allowing the student teachers to use their classes. This was not answered as frequently in the affirmative, only sixteen out of the fifty-three institutions making an extra remuneration to the critic teacher. Five of these paid the schools, eleven the critic teacher. The recompense was not always money, but in one case the critic teacher was allowed to take work at the university free of charge, and in another case a scholarship was given to the public school system for one of its regular teachers.

Sixty per cent of the institutions, then, selected the critic teachers and half of that number or 29 per cent paid the critic teacher or the school in which practice teaching was carried on.

As for payment of the student teacher, one institution allowed pay "sometimes," and one reduced the tuition during the term in which the practice teaching was being carried on. It seems to be the general principle that the student should not be recompensed other than by credit.

The length of the practice teaching course was generally either one year or one semester. Both replies appeared the same number of times and in the same proportion in the two groups of schools. Other replies varied from nine weeks to two years. These replies were scattering, one or two institutions citing each of the various lengths of time. The student teachers were most frequently in the schools for a single period only. Six schools, all without experimental schools, reported that the student teacher was in the school all day, and thirteen, one-half day. The student teacher in 50 per cent of the cases, in both groups, met the same class for practice teaching every time that class met. An additional 35 per cent met the same class two or three times a week. I interpret this also as meeting the class every time it had physical education, as by far the majority of high schools have physical education two or three times a week. It seems to be a general policy to allow the student teacher to follow one class through at least part of his practice teaching experience, and so gain a total picture of the progress of that class.

We tried to find out something about the amount of time spent observing, assisting, and teaching. The replies were so varied that it is almost impossible to summarize them. In general the tendency seemed to be for the student to do actual teaching more than half of the time spent in the schools. The greatest number of replies, 30 per cent, indicated that the student taught all the time, or all but the first week or so. There was no real difference between the two groups.

Plans were required from the students in all but two of the institutions replying. Of these two, one followed a syllabus and one made no answer. We inquired about semester plans, unit plans, and daily plans. The frequency of the requirement of the different types was evenly distributed. Sixteen per cent of all institutions required three types of plans. More of these were institutions with an experimental school. More of the other schools required daily plans, or unit and daily plans. We were also interested in finding out by whom the plans were checked. Again there was little difference between the group having an experimental school and the group without. The plans were most frequently checked by the supervisor alone, 43 per cent of the cases; then by the critic teacher alone, 32 per cent. The other plans were checked by a combination of the supervisor of practice teaching and the critic teacher, or the head of the department in which the teaching was done.

The next four questions we thought were the crucial ones as to whether the student teacher was getting a complete experience. These were: "Are the practice teachers allowed to work out their plans in their teaching?" "Must the practice teacher follow the methods of teaching set up by the critic teacher?" "Does the practice teacher have any part in organizing the class?" "Does the practice teacher have any part in grading the class?" The answers to the questions show that they were not nearly specific enough. A further study on the details suggested by these questions would probably prove much more interesting and informative than the attempt I have at hand. The replies to these questions were grouped in four different ways for study. First, as to whether or not an experimental school was available. Then, ignoring the group with an experimental school, we divided the answers according to the selection of the critic teacher. We next used the payment of the critic teacher, or of the institution in which the practice teaching was done, as a basis for the division. And lastly, including all the replies, we used as the criterion whether or not the critic teacher had anything to do with checking the lesson plans.

When the answers were divided on the basis of the selection of the critic teachers it was found that the critic teachers had slightly more to do with checking the plans when she had been selected (56 per cent against 32 per cent), and, when the critic teacher was paid, much more was done in this regard—76 per cent having some part in checking against 20 per cent of the other group. Both selection of the critic

teacher and payment—especially the latter—seem to encourage the critic teacher to take a more active part in helping the student teacher.

To the question, "Are the practice teachers allowed to work out their plans?" the answer was overwhelmingly "Yes." In 60 per cent of the cases the "yes" was unqualified. Only five institutions (9 per cent) said "No," four of these five having no experimental school. The other replies (30 per cent) were "to a limited extent," "with modifications," and so forth. There were more of these replies also in the second group. With further analysis, there were more affirmative replies in the group where selection had taken place, 47 per cent against 33 per cent, and 16 per cent against 40 per cent "noes" in the unselected group. Whether these differences are great enough to be significant is hard to say. All the negative replies were in the schools that did not pay the critic teacher, but the number was very small and extra remuneration to the critic teacher seemed to make little difference in the work of the practice teacher. However, when the critic teacher had some part in checking the plans there was a decided difference. Eighty-four per cent were allowed to work out their plans in this case.

The trend of the answers to the question, "Must the student teacher follow the methods set up by the critic teacher?" is very much the same. This question as stated did not imply what was meant, because it would probably be undesirable to have one class in which practice teaching was being done, conducted entirely along different lines from the rest of the physical education in the school. And it is usually true that the regular or critic teacher, being more experienced than the student teacher and in closer touch with the whole school organization, would be likely to set up methods of teaching which would be best for that situation. The answers reflected this, as they were usually qualified by some phrase such as "to some extent," "methods adapted," "if approved by the critic teacher." Surprisingly, the greatest difference appeared in the division into selected and unselected critic teachers. Here the greatest number of "Yes, they must follow the methods set up by the critic teacher" appeared in the group where the critic teacher had been selected. This reply, together with those with the qualifications "usually," and "to some extent," was found in 65 per cent of these answers, and in 48 per cent when the critic teacher had not been selected. This was rather an upset to our theories. In none of the schools where the critic teacher had some part in checking the lesson plans was following the methods already set up absolutely obligatory, but in most of them it was necessary to some extent.

As for the participation of the student teacher in the organization and grading of the class, the response was very generally "Yes." No matter how the questionnaires were divided, in over 60 per cent of each group some part in class organization was allowed. Not so many took part in grading, but the number where this was allowed was still much

greater than where it was not allowed. Ninety per cent of the institutions selecting the critic teachers were able to give the student teacher some experience in organizing a class, as against 66 per cent where the critic was not selected. But the people in the nonselected group had more part in grading—66 per cent against 47 per cent. Payment of the critic teacher made no difference. The sharpest difference in the picture of the two groups came when the answers were divided on the criterion of the person who checked the lesson plans. When plans were known to the critic teacher and had been criticized by her, there was more participation in organization and grading by the student teacher. (Organization, 76 per cent against 57 per cent; grading, 73 per cent against 42 per cent.)

In reviewing these figures, it seems that whether an institution has an experimental school or not makes little difference, and remuneration of the critic teacher or of the institution where the student is teaching has apparently no effect on the amount of student experience. The two factors which seemed to be significant were the participation of the critic teacher in criticizing the plans of the student teachers, and, less sharply, the selection of critic teachers.

While the results of the study as they stand may not be very noteworthy, I think there are some interesting problems suggested. It occurs to me there is probably a significant relationship between the manner of supervision and the experience of the student teacher. Questions regarding the duties of the supervisor were not included here because a comprehensive survey of the supervisor's activities was included in Miss Baker's study, "The Supervision of Practice Teaching in Physical Education in Undergraduate Institutions in the United States." A more detailed study of the experiences of student teachers in the practice class should be done before significant correlations with factors in organization can be made.

In spite of apparently favorable responses, we found comments on several papers to the effect that their situation was not entirely satisfactory in providing a complete experience to the practice teacher. This indicates that other places besides the institution with which I am concerned may be having difficulties in the adequate placement of practice teachers.

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A Motion Picture Survey in the Field of Sports for College Women

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PART I

THE INFLUENCE of motion pictures on children and youth has been the subject of extensive investigation by the Payne Fund Committee on Educational Research in Motion Pictures, under the chairmanship of Dr. W. W. Charters of The Ohio State University. The investigation, which extended over a period of five years (1928–33), included studies to find out what children learn from motion pictures and the effects of motion pictures on children's attitudes, emotions, and conduct. The reports of the various members of this committee, known as *The Payne Fund Studies*,[1] indicate that:

1. Each child, in areas where motion pictures are available, goes to the movies on an average of once a week.
2. Three out of four of the pictures that are shown are related to sex, crime, or romantic love.
3. The child retains two-thirds as much as the adult does from his attendance at the movies.
4. Motion pictures change children's attitudes, and these changes are relatively permanent.

One measurement of the emotional effects of pictures was made in terms of the influence of movie attendance on children's sleep. The general conclusion of this study is that "seeing some films does induce a disturbance of relaxed recuperative sleep in children to a degree which, if indulged with sufficient frequency, can be regarded as detrimental to normal health and growth."[2]

These *Payne Fund Studies* form a very sound basis for the work of many organized groups interested in raising the standards of entertainment motion pictures and will undoubtedly have some influence on the producers themselves. More important perhaps, the facts brought forth concerning the moral and social value of the motion picture have heightened the interest of educators in the use of the motion picture in the school.

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[1] New York: Macmillan Company, 1933.

[2] Samuel Renshaw, Vernon L. Miller, and Dorothy Marquis. *Children's Sleep*. New York: Macmillan Company, 1933.

The influence of films designed specifically for use in the classroom has been made the subject of many recent studies. There are, for example, the studies conducted by Freeman and his co-workers at the University of Chicago, by Knowlton and Tilton at Yale University, and by Wood and Freeman, Marchant, Consitt, and the National Union of Teachers in the schools of Middlesex, England. There are, in addition, the studies made by Clarke, Arnspiger, Erpi Picture Consultants, Harvard University, and the very recent Pittsburgh study. All these investigations reveal that visual aids have definite values. The results of these experiments, which include the use of the major visual aids, demonstrate that the proper use of visual materials (1) increases initial learning, (2) effects an economy of time in learning, (3) increases permanence of learning, (4) aids in teaching backward children, and (5) motivates learning by increasing interest, attention, self-activity, voluntary reading, and classroom participation.[3]

There is, therefore, proof of the value of motion pictures in education. And, since motion pictures are educationally valuable, teachers will wish to use them in their work as an improvement over and supplement to other visual aids. However, the fact that the value of the motion picture has been established does not assure us:

1. That there are enough films for the use of teachers of the many school subjects.
2. That the films that do exist are of high quality.
3. That teachers have at their disposal the mechanical equipment necessary to make use of films.
4. That teachers will be trained in methods of using this new tool.

This investigation relates primarily to a study of these four problems.

Perhaps the most significant plan to meet these needs is offered by the American Council on Education, of which Dr. George F. Zook is president. The Council proposes to establish an American Film Institute, the function of which would be to encourage the use of the motion picture in education. This plan took definite form on December 4 and 5, 1934, in Washington, D. C., when a group of educators proposed the following objectives for the Institute:

1. To develop a national appreciation of the potential contribution of the motion picture to the cultural life of America.
2. To collect and distribute significant information concerning motion pictures in education at home and abroad.
3. To stimulate the production and use of motion pictures for educational purposes.

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[3] Cline M. Koon. *Motion Pictures in Education in the United States.* Chicago: The University of Chicago Press, 1934.

4. To promote the cooperation of all agencies interested in the production and use of motion pictures in education.

5. To initiate and promote research pertaining to motion pictures and allied visual and auditory aids in education.[4]

Since the American Council on Education has a membership representative of twenty-three national education associations, there can be little doubt about the sagacity of this plan for centralization of organization. It would seem the most expedient and most reliable way to proceed to quality films, assured market, and adequate distribution.

As a part of the preliminary work of the American Council in the field of motion pictures, the National Section on Women's Athletics of the American Physical Education Association has been invited to participate in a motion-picture project in the field of physical education. It is in the interest of this participation that the present study has been developed.

PART II

THE MOTION PICTURE IN PHYSICAL EDUCATION

The motion picture has an important and distinctive function in physical education. Physical education is here defined as "that phase of education which is concerned . . . with the organization and the leadership of children in big muscle activities, to gain the development and the adjustment inherent in the activities according to social standards."[5] The teaching of physical education inevitably involves the teaching of a great number of motor skills. The teachers of these skills may be served especially well by the motion picture. No very clear conception of sports activities can be secured from "still" pictures. The method in use for many years has been demonstration and explanation. In both there has been an attempt to analyze motion. This is difficult material to present because the motion in sports activities is so rapid that the student cannot easily understand it. The introduction of the motion picture makes possible the slow-motion analysis of a rapid movement which can be shown in no other way.

Freeman says, "the usefulness of motion pictures would be enhanced if they were so organized as to confine themselves to their peculiar province. Their province seems to be the exhibition of moving objects and particularly to facilitate the analysis of motion."[6] He further says, "the operation of a machine or the complex of movement which compose an act of skill are probably most clearly apprehended by means of the perception of motion."[7] This knowledge has long been utilized by industry.

[4] *Educational Screen*, (March, 1935), 72.

[5] Clark S. Hetherington. *School Program in Physical Education*. Yonkers, New York: World Book Company, 1922.

[6] Frank N. Freeman. *Visual Education*, p. 77. Chicago: University of Chicago Press, 1924.

[7] *Op. cit.*, p. 73.

Through the use of the motion picture industrial engineers have effected considerable saving of both energy and time.[8]

Physical education as a teaching field has not, up to date, used the motion picture extensively. While there exist a number of films dealing with sport subjects, very few of them are truly educational. To make a study of the specific values of the motion picture in the teaching of physical-education activities is impossible at the present time because of the lack of scientific material in this area. The teaching of skills through the use of films, therefore, bristles with unsolved research problems.

Football coaches have utilized the motion picture in the analysis of techniques and team plays, it is true, and have observed the benefits. Most of such films, however, have not been made available commercially. The majority of the sports films that are produced commercially have been made for purposes of entertainment.

There have been two attempts by the American Physical Education Association to produce educational films in the field of women's sports. Their National Section on Women's Athletics has sponsored the production of a film on "Basketball Fundamentals" and one on "The Front Crawl," but neither is available as yet for general use. The effort is in the right direction in that the content of the films was determined by experts in the physical-education field with the purpose of facilitating the analysis of the skills involved.

To be truly educational a sports picture should probably contain a large proportion of slow-motion analysis. This type of film consumes a great deal of footage and hence involves considerable expense. For this reason most of the films made by private individuals or schools involve very little slow-motion analysis and are therefore of little value in the actual teaching of skills. With the possibility of the organization of an American Film Institute it may be that national educational organizations will receive financial support which will make it possible for experts in the various fields to develop this valuable teaching aid in a scientific way, and to make films of good quality available to the nation generally at a minimum cost to the schools.

Briefly it may be stated that some of the advantages of adding the sports motion picture to the physical-education teacher's materials are as follows:

1. Through slow-motion analysis of sport techniques, it is possible to follow: (*a*) positions of body, (*b*) execution of movement, (*c*) planes of movement, (*d*) relation between different parts, (*e*) handling of equipment, (*f*) muscular exertion, (*g*) plays of teams.

2. The film affords an opportunity to view the separate skills used in a game not only under playing conditions but when practiced in isolation from the game.

[8] See F. B., and L. M. Gilbreth. *Applied Motion Study.*

3. The timing element which is so important in sport performance can be clearly shown.

4. The contrast between good and bad form can be shown to an advantage.

5. Students with poor coordination could gain much through the use of the "endless loop" type of film which would repeat specific techniques.

6. The "close-up" is an advantage in teaching large groups.

All these contributions are unique in that they can probably be better presented by the motion picture than by demonstration, still pictures, chart, diagram, book, or teacher.

But, while the analysis of activities by slow motion is doubtless the most valuable contribution the motion picture can make in physical education, other possible contributions should not be overlooked. In the training of teachers of physical education the motion picture can be of great importance in the teaching of such subjects as human anatomy, physiology, kinesiology, health education, physiology of exercise, therapeutics, and principles of physical education. This study, however, is confined to a discussion of the motion picture as it applies to the field of women's sports.

PART III

The ultimate commercial production of motion pictures for use in sport-teaching fields depends upon the determination of (*a*) interest and demand, (*b*) availability of equipment, and (*c*) the value of films for certain activities. Information is needed on all these points. It is the purpose of the writer to present the information that was assembled in the course of this study.

The techniques used to secure these data were:

1. The development and sending of a questionnaire to the directors of physical education for women in 385 colleges and universities throughout the United States. The women addressed are considered experts in their fields.

2. The sending of letters to the leading national organizations interested in women's sports to ascertain if any educational films are available.

3. The evaluation of a number of existing films in the field.

The questionnaire was returned to us by 267 colleges and universities, representing 45 states and the District of Columbia. All figures and percentages mentioned are in relation to the number of questionnaires returned to us (267).

A. Equipment

One of the first questions faced in the production of a film is its possible market. How many schools of physical education are likely to buy an excellent film produced by one of the commercial companies? A number of factors determine such purchases, important among which is the question of the extent to which such schools are equipped to show mo-

tion pictures. Our query in this field brought forth the following data:

Number of institutions equipped to *show* silent motion pictures	205	76 per cent
35-mm. silent film	136	50 per cent
16-mm. silent film	159	59 per cent
Number of institutions equipped to *show* sound motion pictures	33	12 per cent
35-mm. sound film	26	9 per cent
16-mm. sound film	15	5 per cent
Number of institutions equipped to *take* silent motion pictures	100	37 per cent
35-mm. silent films	37	14 per cent
16-mm. silent films	90	33 per cent
Number of institutions equipped to *take* sound motion pictures	2	
35-mm. sound films	0	
16-mm. sound films	2	
Number of institutions considering the purchase of equipment	58	10 per cent
Number of institutions in which the equipment is university owned and available to all departments	186	69 per cent

All other institutions report a variety of ownership among which are: college of education; local theater; department of physical education; trustees; agricultural extension; R.O.T.C. band; women's athletic association; medical school; members of faculty; forestry school; athletic department; churches; and publicity department.

Conclusion.—Generally speaking, the colleges and universities are equipped to show motion pictures. The use of the 16-mm. projector seems more prevalent. The silent film is more frequently used at the present time than is the sound film. Whether the university-owned equipment is available in sufficient quantities to meet the needs of all departments, the facts of the questionnaire do not indicate. The intention to purchase equipment is an indication of a need.

B. Interest

In answer to the question "would you be interested in motion pictures specifically designed as instructional aids in the teaching of sports?" the 267 experts replied as follows:

Yes	254 or 95 per cent
No	8 or 5 per cent

Certain types of films were then suggested and the experts were asked to number them from one to seven in the order of their preference. The results of the voting are tabulated as follows:

TYPE OF FILM	1	2	3	4	5	6	7
1. Illustration of correct and incorrect techniques of sport skills	69	82	34	12	7	6	10
2. Action pictures of a well-played game	13	42	92	21	20	16	12
3. Action pictures of a well-played game combined with illustrations of correct and incorrect techniques	142	49	19	4	6	1	1
4. Historical development of specific sports	3	8	19	26	40	48	76
5. Action pictures filmed at leading district and national tournaments and championships	1	11	15	57	59	39	33
6. Champions in action	1	21	25	62	45	32	33
7. National sports in various countries	1	11	18	40	39	66	46

A list of twenty-eight sports activities was then submitted and the experts were asked to number from one to ten the activities in which instructional films would be of most value to them.

Conclusion.—The interest in motion pictures specifically designed as instructional aids in the teaching of sports seems universal. The type of picture most desired is one which portrays a well-played game and illustrates its correct and incorrect techniques. The general interest in pictures of champions in action should not be overlooked. The use of champions in the technique and action pictures, to a limited extent, would probably be expedient. Instructional films in specific activities were voted the most valuable in the following sports:

1. Tennis
2. Basketball
3. Field Hockey
4. Archery
5. Swimming
6. Volleyball
7. Diving
8. Baseball
9. Golf
10. Soccer

It would seem, therefore, that the greatest immediate demand would be for films of use in the teaching of these sports. Although films for use in the teaching of these sports should be produced first, it is not implied that films for other sports should be neglected if they are in demand by over 25 per cent of the colleges.

C. Rental and Purchase Demand

The producer is interested in the possible demand for proposed motion pictures. For this reason the experts were asked to reply to the question, "would you be interested in renting films?" Their replies were as follows:

Yes .....234.....88 per cent
No ..... 27.....10 per cent

Those signifying that they would be interested in the purchase of films, if they were available, numbered 136 or 51 per cent.

Conclusion.—Inasmuch as the number of institutions involved in this study are representative of large and small institutions throughout the United States, there is every indication of a substantial demand for the rental and purchase of films.

D. Availability of Films

In Section IV the experts were asked to report films on women's sports which they knew to be available, and, if they had seen them personally, to rate them poor, fair, good, or excellent. Forty-eight films were mentioned covering sixteen different activities. A questionnaire, seeking more specific information, was then sent to the reported producers of these films. As a result, it has been found that many of the films no longer exist, are personally owned and not available, are specifically designed for entertainment purposes, have limited availability, or are useful chiefly for interesting men in activity. A number of the more promising films were reviewed, but, except for the two mentioned on page 162, there were no films of especial value in the classroom teaching of women's sports. It is undoubtedly true that those addressed do not have knowledge of all existing films. Further study should be made to complete the survey.

Correspondence with the following national organizations indicated that they have no available films on women's activities at the present time:

The United States Lawn Tennis Association
The United States Golf Association
The National Archery Association
The Amateur Athletic Union
The National Amateur Athletic Federation, Women's Division
The National Recreation Association
The Camp Fire Girls
The American Red Cross

Conclusion.—The number of existing films, dealing with women's sports in such a way as to be of value in teaching, is negligible. The number of conflicting judgments on the same film make it obvious that definite criteria for the evaluation of sports pictures should be established.

PART IV

SUMMARY AND RESULTS

The conclusions of this study may be summarized as follows:

1. Because the motion picture facilitates the analysis of motion as no other medium can, it has an important function in the field of physical education.

2. Colleges and universities, generally, are equipped to show motion pictures, the use of the 16-mm. silent projector predominating.

3. There is a universal interest, on the college level, in motion

pictures specifically designed as instructional aids in the teaching of women's sports.

4. The type of picture most desired is one which combines the analysis of correct and incorrect sports technics with the portrayal of a well-played game, and shows some champions in action.

5. Taking into consideration the present equipment and facilities of college and university departments of physical education, instructional films would be of the most general value in the following activities: tennis, basketball, field hockey, archery, swimming, diving, golf, and volleyball.

6. There is every indication of a substantial demand for the rental and purchase of films produced as teaching aids in the field of women's sports.

(E.N.: Through the financial assistance of the American Council on Education, this study has been extended to the secondary schools of the United States and a report of the study will appear in a future issue).

BOOK REVIEWS

ORGANIZATIONS FOR YOUTH. Elizabeth Pendry and Hugh Hartshorne (New York: McGraw-Hill Book Company, 1935) 359 pages, $2.75.

This book will be of interest to physical educators who wish to acquaint themselves with youth organizations operating in the leisure field. Forty agencies and programs are presented in considerable detail. They are grouped for convenience in five classes: independent societies such as the Boy and Girl Scouts; junior programs of adult groups, as represented by the Kiwanis, Rotary, DeMolay, etc.; plans for schools, such as the Iowa Plan; special interest groups like the Junior Audubon Societies; and inter-religious groups such as the Y.M.C.A. The authors make no attempt at critical analysis, preferring rather to let the various programs speak for themselves; neither have they exhausted the list of agencies in the field. The forty agencies chosen are those of national or international scope, and therefore of interest to a wide range of readers. Strictly sectarian organizations are not included, but a large number of them are gathered together in an appendix, and listed with names and addresses.

The material is well-organized and very readable. Each organization was asked by the authors to set down its "main purpose, history and growth, program and procedure, philosophy and method, its use of motives and rewards, and such evidences of its success as its proponents care to offer." This they have done with clearness and conciseness, and incidentally with admirable restraint, considering the difficulty any organization which deals in subjective values has in being objective.

Of the authors' own commentaries on their subject, one section is particularly important: the paragraphs on unmet needs. In company with a host of other observers today, they are concerned that the youth of the eighteen-to-twenty-five-year age are to such a large extent unprovided for.

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LUTHER HALSEY GULICK. Ethel Josephine Dorgan. (New York: Bureau of Publications, Teachers College, Columbia University. Contributions to Education No. 635).

In this biography Miss Dorgan gives a vivid and sympathetic portrayal of Dr. Gulick as a man whose love of humanity and whose devotion to its service were the mainsprings of all his endeavor. His dynamic and vigorous personality, his breadth of vision, his tireless energy, are depicted in the versatility of his many-sided career.

To this biography Miss Dorgan brings a wealth of material gathered from many personal interviews with contemporaries of Dr. Gulick, from a careful and thorough study of the many articles and books written by Dr. Gulick, and from other articles concerning his work.

It reviews for us his great influence on and contributions to the field of physical education. His vision of the possibilities in physical education was far ahead of his time, particularly from the point of view of health and the psychology of play. It depicts for us Dr. Gulick's unusual organizing and pioneering ability in blazing new trails.

The biography gives a thoughtful and discriminating record of Dr. Gulick's pioneer work with the Y.M.C.A., the

Playground Association, the Public School Athletic League, the folk dance movement, the health of the school child, the organized summer camp movement, the Camp Fire Girls and a host of other organizations.

All through the biography are delightful little touches bearing on Dr. Gulick's whimsical sense of humor and on his warmth and friendliness.

To the many warm admirers of Dr. Gulick this timely biography brings anew the stimulation and inspiration of his vigorous and challenging personality.

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CHARACTER DANCES FOR SCHOOL PROGRAMS. Hilda C. Kozman. (New York: A. S. Barnes and Company, 1935) 115 pages; illustrations and music, $2.00.

This book should be a valuable help to teachers and recreational leaders who are called upon to prepare entertaining programs for almost any occasion.

Twenty-four dances, each with its own music, are included in the volume. The listing of these dances according to difficulty will be of help to the busy teacher in search of material for groups with varied abilities. The dances included are varied and cover a wide range of interests, with reference to special occasions and programs. Among them and illustrative of the range are an Irish jig, an Irish lilt, a Russian peasant dance, an Italian holiday dance, one Spanish and three Japanese dances, one elfin and one pirate dance, a soft-shoe and a clog, one rustic dance, one each of the Colonial and *Directoire* periods, and several of the imitative and comic type. The majority of these are adaptable to either adults or children.

The book contains several valuable and unique features that make it especially usable. The dances are illustrated with fine photographs. In connection with each dance, suggestions are given on the appropriate costuming. The first few pages contain a clear analysis of the steps used later in the book. This feature makes doubly sure an accurate understanding of the detailed descriptions and explanations of the dances which follow.

The person who is called upon to prepare programs for special occasions will find collected here in one volume a wealth of material. The careful descriptions and suggestions are of such a nature as to make for ease in the selection of activities which will provide entertainment of interest to both participants and audience.

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METHODS AND MATERIALS OF HEALTH EDUCATION. Jesse F. Williams and Fannie B. Shaw. (New York: Thomas Nelson and Sons, 1935) 331 pages.

The excellent organization of this publication is an outstanding and welcome feature. Writing plainly and logically, the authors first clarify to a considerable extent the confusion which exists in health terminology. A part of the report of the Committee on Terminology in Health Education of the Health Education Section of the American Physical Education Association is incorporated in the first chapter. A plan showing the administrative divisions of a health education program is appropriately presented and completes the initial chapter.

A considerable portion of the book is devoted to a discussion of the nature of the child. This section will be particularly significant to those students whose training in education has been meager. It is important that a clear understanding of the child—the one who is to be taught—be required as a fundamental background for the further development of methods and materials in health education. The social, mental,

economical, and physical aspects of childhood are adequately elaborated.

Excellent analysis of healthful school living, health services, the role of official and non-official organizations in health education, construction of the curriculum, health instruction, materials for teaching health, tests and measurements, and the health of the teacher complete this fine contribution to the literature in this field.

Experienced teachers, student teachers, nurses, physical educators, and physicians can glean much from Dr. Williams' and Miss Shaw's *Methods and Materials of Health Education.*

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Active Games and Contests. Bernard S. Mason and E. D. Mitchell. (New York: A. S. Barnes and Company, 1935) 600 pages; 101 illustrations. $3.00.

Why do men play games? The fundamental reason for games is to get exercise that is training of mind and muscle, in readiness for the struggle of life.

This is so important that it has evoked the ancient saying that all of England's battles were won on the ball field; that is to say, the qualities of muscle, mind, judgment, and coordination that, in the end, won battles were originally developed in the ball games of school days.

The underlying thought is beyond challenge. But the exact application raises difficulties. Those not gifted at the outset with the equipment of a victor are not likely to win large opportunities on the ball ground; for, in most great schools, the best opportunities are offered only to those who have least need for them.

However, there can be no question that games are man's instinctive response to the need for training preparatory to the life battle, but without danger, hate, or destruction. No game is perfect that does not consider the fourfold nature of real development—the body, the mind, the imagination and the social or team instinct. Thus, no one has ever found dumb-bells of permanent use or interest; they are purely physical. No one finds spelling games of permanent value; they are mental only. Imitations of animals or persons are funny for a little while; but they are solitary games. And such simple social games as chair dancing, or alphabet, have slight and passing interest. No! the ideal game must play on and develop our fourfold nature and gifts.

These facts are amply recognized throughout the *Active Games and Contests;* and in the vast assemblement of games, one can surely find one for every occasion and group, indoors or outdoors, with apparatus or with nothing but what nature bestowed on the individual.

Not once, but many times, it has been my lot to inspect a camp or school that had gone stale; and, when I sought out the reason back of it all, it was clearly the total lack of interest in the playground, the recreational side of life and training. I remember in particular one camp of 300 boys who were discontented and quarrelsome. As one or two of them said to me: "Aw, there's nothing to do; may as well go to bed."

I set to work to introduce a number of games which called for little or homemade apparatus, and did them a lot of good. But my stay was brief—a couple of days—and all I could do was show them the way and give them a little start on it.

How much easier would have been the task, and how much better the solution, if I had been able to say: "You get Mason and Mitchell's encyclopedic book on games and contests; and if you don't find in that ample suggestion for the making of wholesome development fun-training, you might as well shut up the camp and go home."

In brief, then, the present volume is by far the largest and best collection of games that the reviewer has ever seen; and there can be little doubt that in

the future it will be considered an essential of every camp and school equipment.

ERNEST THOMPSON SETON,
Santa Fe, New Mexico

KINDERTURNSTUNDEN 4. SCHULJAHR. Dr. Gaulhofer, and Dr. M. Streicher. (Wien, Austria: Deutscher Verlag für Jugend und Volk, Dr. Ignaz Seipel-Ring 1.)

The authors in the introduction to this useful book of physical education activities for the fourth school year children of Vienna state explicitly that they dislike "model lessons." This is due to the fact that when such lessons are used indiscriminately for this group, they become set and lifeless. The material given in this book they wish to have regarded not as a series of model lessons, but as hints and suggestions to be adapted by the teacher to the needs and facilities of a specific group and a specific situation. They find that the physical education hours for children are often in the hands of those who have had little training in physical education or those who have all too little time to find new and interesting material. The book, therefore, is primarily for the schoolroom teacher who needs hints and suggestions of new material. It would be valuable, however, to anyone who has charge of the physical education or recreation of nine year olds. It is a practical, useful handbook of activities. The theory of physical education is not discussed at length, as the authors have set forth their beliefs and theories in a former book called *Die Quelle* (1932), but they do give suggestions of form in the activities and recommend that the correct way of doing any of the activities be stressed rather than effort for distance or speed.

The introduction also describes the characteristics of the fourth grade children and methods of class organization. There is an interesting description of apparatus, which is light, inexpensive, which can be put away in a very small space, and some of which can be made by children themselves.

There are in the book twenty-five series of lessons, each containing from six to ten activities. A few dances and singing games as well as activities involving jumping, turning, stopping, climbing, throwing, in fact, all the natural movements of the child are included. They are grouped under headings telling where they may be most easily used, i.e., on the playground, in the gymnasium, in the classroom, on an excursion (a hike as we would say), in the swimming pool, in the snow, on the ice, etc.

What strikes the eye of the reviewer is the ingenious schemes by which the children use a great variety of movements, and the simplicity of the whole series of activities which brings such varied results. Natural movement is stressed throughout.

This is not a book on formal gymnastic exercises. It is rather a series of games and self-testing activities, all of them demanding natural movement. There are in addition some delightful sketches of children doing the activities, and diagrams of the class arrangement for the games.

To make the book even more helpful, there is an index in the back giving the number of the lesson, the page, the place (outside or in, etc.) for which the program is planned, the time of year when that particular lesson could be most useful, and a list of the activities or games used in the lesson.

This is indeed a practical and useful book and one which contains new and interesting suggestions for many of us in the United States as well as in Austria.

Other books by the same authors and published by the same house are *Grundzuge des Schulturnens*, *Natürliches Turnen*, and *Zur Gestaltungdes Mädchen—U. Frauenturnens.*

DOROTHY S. AINSWORTH,
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A REVIEW OF PUBLIC HEALTH REALITIES. Papers of Charles V. Chapin, M.D. Selected by Frederick P. Gorham, A.M., Sc.D., Edited by Clarence L. Scamman, M.D., with a Foreword by Haven Emerson, M.D. (Commonwealth Fund, 1934), 244 pages. Cloth. $1.50.

How can one resist telling the world that he has just finished reading a classic which is filled with abundant living! What a joy to be able to snatch some of the wisdom of one who has always been years ahead of his time in his field. The distinguished Dr. Charles Value Chapin, for forty-eight years Superintendent of Health in Providence, Rhode Island, has left a document of achievement that may well be the envy of all health-conscious and health-minded leaders and teachers.

This is the sort of book that leads one on from a mere cursory glance to an absorbed attention. It inspires one at once with courage and confidence. It reveals the brilliant mind, the practical and dynamic attitude, and the simplicity of a truly progressive humanitarian.

Let me quote from the excellent foreword by Dr. Haven Emerson, "In the brief measure of these pages is contained not only the record of past progress in thought and action, but many of the necessarily permanent principles which will guide practitioners of preventive medicine in the future. This new testament of public health is as well a guide to the scientific manner of inquiry and argument, and a philosophy of performance more packed with wisdom than are shelves of encyclopedic volumes. The medical student and practitioner and the medical officer of today will be well ahead of average thought and conduct if they accept as their *vade mecum* in disease prevention these terse and practical essays hammered out of daily work by the pounding of new facts upon the anvil of a critical mind.

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And in the language of a popular broadcast, "This is just the beginning."

No true lover of children—today's children are tomorrow's public—should fail to pore over this book.

M. DONALD ADOLPH
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FINANCING MUNICIPAL RECREATION. Randolph O. Huus. (Menasha, Wisconsin: George Banta Publishing Company, 1935) 249 pages. $2.50.

Drawing from the deep well of his personal experience in municipal recreation administration, Randolph Huus has produced two buckets brimful and overflowing with modern practices and procedures in financing municipal recreation.

Before you sip from the fresh clear waters of "Income Sources" for municipal recreation, together with many ideas concerning means for increasing services and facilities, the author points out a significant trend away from private and toward public support of recreation. His attitude throughout reflects a wholesome, sympathetic, positive spirit towards this new municipal function, which has courageously faced the problems of enormously increased demands for service during the years of depression on the one hand, and constant local pressure for decreases in appropriations from tax sources on the other hand. For the time being, Federal and State aid is providing a gap-filler which has reacted favorably through the emergency but may have serious consequences in the future.

The author has drawn, and spills from his first bucket, information gleaned from the actual experiences of many cities throughout the country con-

cerning the sources of funds used for municipal recreation. They include, in addition to income from general taxation, special assessments, excess condemnation, gifts, transfers, leases, permits, and income from park and recreation properties.

Pointing out favorable as well as unfavorable reactions to these many income devices, Mr. Huus proceeds to draw his own conclusions without sidestepping the issue. Some of these conclusions are quite at variance with previous opinions on the same subject expressed by recreation leaders.

When you dip into the author's second bucket, you will enjoy a few "pauses that refresh" if you are recreationally minded. The great increases in expenditures for operation, maintenance, and capital outlays for parks and playgrounds over a relatively short period clearly point out the necessity for careful preparation of annual budgets, together with a fundamentally sound system for planning recreation expenditures. A practical method, based on sound municipal budgeting practices which adhere closely to a plan set up by A. E. Buck, outstanding authority in this field, is described. Ways and means of making certain recreation activities self-supporting, and others at least partially so, are told.

This book gives a fresh impetus to the whole problem of recreation budgeting.

CHARLES W. DAVIS
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INDIVIDUAL EXERCISES. George T. Stafford, Harry B. DeCook, and Joseph L. Picard. (New York: A. S. Barnes and Company, 1935) 111 pages. $1.00.

There is apparent in the literature of our profession today an increasing amount of material written, not primarily for the administrator or teacher, or even for the major student, but for the average college man or woman in the physical education class. This extension of the workbook plan to physical education activity classes is a little more than just an activity; it gives the student some inkling of the "whys and wherefores" of activity, as well as the "hows."

The authors of *Individual Exercises* have produced the first volume that might truly be called a workbook in the field of corrective physical education. *Individual Exercises* could well be given to college students for references on the cause and treatment of the various conditions for which they have been assigned to corrective classes. Discussion of the various medical and orthopedic conditions, for which corrective exercises are indicated, is given very briefly in non-technical terms. The criticism might be made that the discussion is so simplified that it is occasionally somewhat misleading, and some teachers will deplore the fact that the whole subject of posture is dismissed with two pages of rather general statement. The "old standbys," kyphosis and lordosis, are barely mentioned. The unusual emphasis on medical rather than orthopedic conditions is undoubtedly a reflection of the fact that in many university and college departments, the students who are assigned to corrective classes are those who have failed to pass the routine medical examination. It is evident that this book is prepared chiefly for male students. Many of the exercises described seem unduly vigorous to one who has had experience only with women in corrective classes.

A Personal Health Rating Scale is given which would undoubtedly be useful to the student in checking up on his own habits, and to the instructor as a basis for conferences. Some of the items included might be questioned as necessary—or even desirable—practices for universal application, but the instructor can easily make any adaptations necessary to individual situations.

From the standpoint of the teacher, the most valuable section of the book is the fine chapter of specific exercises. Over one hundred exercises are clearly

described and illustrated. The collection includes many old favorites and a few new suggestions. This chapter will be a welcome refresher to the teacher who finds herself prone to use the same few exercises for every student. The directions can be easily understood and followed by students, after the exercises have been demonstrated in class. The physician or orthopedic surgeon who is concerned with prescribing suitable exercises for his patients should also be interested in this excellent collection of exercises to meet a variety of conditions.

This book is a pioneer experiment in the literature of corrective physical education. I believe that it will be a welcome addition to the library of everyone teaching this phase of physical education, as it goes a long way toward filling a definitely felt need for suitable material for students in corrective physical education classes.

ELIZABETH NOYES
Assistant to the Editor, Journal of Health and Physical Education

A TEXTBOOK OF BACTERIOLOGY. Thurman B. Rice, M.D. (Philadelphia: W. B. Saunders Co., 1935) 551 pages. $5.00

This is a textbook confining itself largely to the field of pathogenic bacteriology, general bacteriology being covered briefly. The book is well written and edited, with paragraph headings and a sufficient number of plates for illustration. It is about the right size for the ordinary textbook. Its 550 pages contain the essential material usually found in larger compilations. It is developed primarily for medical students and medical practitioners. Its brevity and condensation have not limited its accuracy. In many ways the elimination of controversial material has made it more understandable and less confusing. It is interestingly written and the information is accurate.

This text is written primarily for the student interested in pathogenic bacteriology, since all but ten of its forty-eight chapters are devoted in general to pathogenic micro-organisms and their significance in disease and public health. While the text is elementary in character, it is very complete in the topics presented, at least from the standpoint of the medical student.

While never technical, the text is none the less kept up-to-date with the most recent developments in the field of bacteriology. In addition, the author has limited the discussions of the various topics to a brief but adequate presentation, thus making the text fairly easy for the student to cover in the time usually set aside for bacteriology. The material is interesting and much more readable than many texts in this field.

The use of non-technical terms has been carried to the extreme in some cases. This seems uncalled for, especially with respect to the topic, "The Bacteriology of the Farm," page twenty-eight, and the topic, "Sour-Milk Group of Organisms," chapter twenty-four, which seem unnecessarily simple in description. The average student capable of digesting the material in the rest of the text should also be able to master the more technical names for the organisms or the topics mentioned above.

The textbook meets a need that has not been supplied by other texts in the field, namely in supplying a book sufficiently condensed so that the average student, either medical or general, interested in pathogenic bacteriology may complete it in the time allowed for the subject.

CLAIR V. LANGTON
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SWIMMING, DIVING, AND WATERSPORTS—A BIBLIOGRAPHY AND GUIDE TO EQUIPMENT AND SUPPLIES. Frances A. Greenwood. (Privately printed, 1935) 50 cents.

This ninety-three page booklet has been compiled and published with the sincere hope that it will be of service to those interested in the field of water sports.

The book is divided into two main sections: a Bibliography, and a Guide To Equipment And Supplies.

The Bibliography lists over six hundred books, articles, and materials on the subject of water sports, these being classified and listed under nine main headings, including books, handbooks, articles, charts, unpublished reports and theses, and motion picture films.

The Guide To Equipment And Supplies lists over five hundred firms furnishing equipment and supplies for all types of water sports, in all stages, from the drawing of plans and selection of building materials to the choice of suits, caps, and recreational equipment. For practically every possible need, there is a choice of many firms from all parts of the country who can meet it. These firms are classified according to the following general types of equipment: construction; building and maintenance equipment; accessory equipment; maintenance supplies; personal equipment; and recreational and water sports equipment and supplies.

Interspersed throughout the entire booklet are facts of general interest concerning swimming, and short articles about the work and plans of the Swimming Section of the Southern District of the American Physical Education Association. It ends with a justification of swimming as "the ancient and ideal sport" and expresses hopes for the future.

This booklet has been widely proclaimed as a splendid and very useful contribution, by administrators, instructors, libraries, and students. The few remaining copies may be secured from Miss Frances A. Greenwood, University of Alabama, University, Alabama.

An outgrowth of this Bibliography has been a Reference Library, composed of many of the books, articles, and materials listed in the pages of the booklet described. It is constantly being added to, and the use of any materials available may be had by any one for the payment of postage and a small expense charge. For specific information concerning any material desired, communicate with Miss Greenwood.

ANN SMITH GIFFORD
Chairman, Water Sports Committee, Women's Athletic Section, A.P.E.A.

AN INTRODUCTION TO HUMAN PHYSIOLOGY. Lathan A. Crandall, Jr., M.D., Ph.D. (W. B. Saunders Co., 1934) 325 pages; 104 illustrations. $2.00.

Such a text has long been needed. For many years I have felt that there was need for a textbook which would fill the gap between high school advanced biology and medical physiology; and this book does precisely that.

In the preface, the author gives the aim of the book as follows: "The aim of this introduction to physiology is to present modern teachings in the subject so simply that they are comprehensible to students who have completed their preparation for college, and so briefly that the student is not lost in a mass of detail."

While Dr. Crandall has succeeded in presenting in a most concise way the ever-enlarging mass of scientific data which usually appears in the standard editions of Howell, Starling, or Bayliss, it seems to me he could have enhanced his work by including frequent summaries and out-of-class discussion questions.

Starting with the familiar premise that we cannot understand the present teachings of the science of human physiology—to say nothing of the future—except as we understand and have a knowledge of past facts, the author attempts, with his brief introductory chapter, to orientate his readers to the physical and chemical background of physiology, the study of the functions of living things.

The twenty-five chapters that follow bring out clearly the results of recent experimental investigations. Especially interesting to students and teachers of physical education are chapters nine, sixteen, and eighteen, which deal respectively with (1) adaptations of the cardiovascular and respiratory systems

to exercise, (2) metabolism and nutrition, and (3) the physiology of muscle.

An unusual feature of this book is that the author has incorporated a most complete glossary in the body of his text. Occasionally, Dr. Crandall assumes the rôle of the hospital professor who glories in his experience in the laboratory.

It is a book well worth having.

M. Donald Adolph
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Team Sports for Women. Alice Frymir and Marjorie Hillas. (New York: A. S. Barnes and Co., 1935) 200 pages. $3.00.

This book was evidently published by the authors for the purpose of giving students and inexperienced teachers the fundamental principles and techniques of our most popular team sports in one book. Too often our students and young teachers complain that they must purchase, or at least search, many books before they obtain the essentials of the three or four team sports which they must master for teaching purposes.

Team Sports for Women, then, is a step toward a useful text of team sports, especially for those individuals who have had inadequate training or who, through unavoidable circumstances, are required to teach sports in which they have never participated.

The authors have dealt with each sport from three aspects, namely:

General Statement of the Game. This treatment goes slightly beyond the mere statement of rules, thereby partially clarifying and summing up the salient features of the game.

Individual Techniques. This section serves to analyze the various fundamentals or techniques of the game, and describes the manner of handling the body and playing equipment.

Tactics. This includes suggestions for position play and team strategy, which are particularly valuable to the inexperienced player or teacher. Unless clearly emphasized, it takes considerable time for beginners to employ the fundamental and simple strategies which are so essential to team play.

The questions and problems included in "Sample Examinations" at the end of each sport section are helpful, as they stimulate thought and tend to bring out the vital points of rules. The final chapters dealing with the subject of officiating and methods are very suggestive and should be helpful to those who are desirous of improving their officiating and teaching.

This presentation of the six sports—baseball, basketball, field hockey, soccer, speedball, and volleyball—should prove of value, especially when used in conjunction with the various official guides. It seems, however, to lack the completeness and clear explanation which are essential to the person with only an elementary knowledge of sports. Should the novice or average student desire to pursue the study of team sports more thoroughly, the "Selected References" given are good.

The book, as the authors themselves state, is not intended to satisfy those who are seeking simply a more advanced training in technique and strategy.

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